REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
00-07-1971		

4. TITLE AND SUBTITLE
Value Engineering

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Clawson, Robert H.

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Technocopy, Inc.

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Materiel Command

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER
AMC-P 706-104

12. DISTRIBUTION AVAILABILITY STATEMENT

A - Approved for Public Release

13. SUPPLEMENTARY NOTES

Engineering Design Handbook

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
Unclassified					
a. REPORT	b. ABSTRACT	c. THIS PAGE		83	19b. TELEPONE NUMBER (*Include area code)*

AMCP-706-104

AMC PAMPHLET

AMCP 706-104

ENGINEERING DESIGN HANDBOOK

VALUE ENGINEERING

HEADQUARTERS, U.S. ARMY MATERIEL COMMAND

JULY 1971

HEADQUARTERS
UNITED STATES ARMY MATERIEL COMMAND
WASHINGTON, D. C. 20315

AMC PAMPHLET
NO. 706-104*

20 July 1971

ENGINEERING DESIGN HANDBOOK

VALUE ENGINEERING

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"This pamphlet supersedes AMCP 11-1, February 1965, including all changes

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PREFACE

Everybody ought to be interested in Value Engineering (VE)!

As wage-earners, the application of VE **is** helping American industry maintain its economic position in world markets, thereby protecting our jobs and careers.

As taxpayers, the Department of Defense (DOD) VE program has come to the defense of the Defense dollar, with audited savings to us of over **$1.1** billion for fiscal years 1963 through 1966.

As consumers, we today purchase many products at not only lower prices, but with greater value as well, because the manufacturer of those products is applying VE **as** an effective management tool.

And all of these VE economic benefits have come rapidly. **As** recently as 1960, when the first edition of this book, titled ***Value Analysis*** (ORDP 40-2), was prepared for what was then the Ordanance Corps of the **U.** S. Army, Value Analysis (VA) was just beginning to find its way into the military establishment.

To spread the word, the first edition copy reflected a pleading tone, **as** much as to say to anyone — individuals and management alike: "Please take a look at this new technique. We've got a good thing here. With it, ***you*** and the Army can save a lot of money!" And, as an inducement to ***take a looh,*** considerable opening copy was devoted to an explanation of the economic reasons for "skyrocketing costs of Defense" and what this technique could do to "hold upward spiraling cost in check".

Even then, the reader was being asked to consider the application of a cost saving technique that was not really new; it dated back to 1947. But in those 13 years, VA was coming of age. Wherever the technique had been intelligently and openmindedly applied, it had been successful. For instance, the preface to the first edition pointed out that: "Most Value Analysis case histories show not only spectacular savings but enhanced product performance and reliability as well".

In retrospect, it has become evident that many did "take a look" — individuals and management alike. And what's more, they must have liked what they saw, because the methodology for identifying and for placing a dollar sign on ***ualue*** is, in a very practical and rewarding manner, becoming a way of life throughout the Department of Defense/Industry community.

With this acceptance and practice of the methodology have come rapid developments in the state of the art, and in the point of its application to the product cycle. What was once considered ***second look,*** Value Analysis — whereby the methodology was applied only after the entity of the product was well established — began moving back in the product development cycle for a ***first look*** into the design aspects of the product. Thus what was originally christened ***Value Analysis,*** synonymously became known as ***Value Engineering*** (VE) — a confirmation that served to justifiably raise the status of (and respect for) the technique.

Value Engineering is therefore no longer on trial. It has proved itself repeatedly. But in spite of its name, its success has not come as a technological technique, but as a potent economic tool for management. Why? Because the record shows, without reservation, that the technique must have the rigorous and unqualified backing of management. Where VE has received this kind of support, management has reaped a retum on investment in the order of 15:1. This kind of performance, management understands!

But management must also understand that VE is basically a *simple* technique, in spite of all the attempts to adorn it with erudite trimmings — an ornamentation that can only serve to stifle its simplicity and reduce its return. Management should.serve as the VE board of directors, establishing policy for the use of the tool, but leaving the actual application of the tool to trained and qualified VE specialists.

This places quite a responsiblity on the VE specalist. But then to successfully apply VE, requires a very *special* type of specialist; he is expected to be a gregarious technologist, a creative thinker, an expert communicator, and, above all else, a super salesman. Why? Because in spite of the success of VE to date, the market for its application, both within and without the military establishment, has only been scratched. DOD wants more Value Engineering Change Proposals (VECP's). Industry wants more effective ways to cut costs. The VE specialist can help both of them!

If this publication has been effectively value engineered, it should help all concerned with attaining the desired VE goals. If it has true *value,* it will perform its basic function of communication — *conveying information.* With this information, the "VE board of directors" should be better prepared to make the necessary decisions, and, the "VE specialist" should be better prepared to be all the things that he is expected to be.

It has been stated that VE has never failed when it has been applied as an organized team effort and with credit given accordingly. Likewise, the author — Robert H. Clawson, Technocopy, Inc. — has been backed by a "team" in the preparation of this publication and gratefully gives credit to: Mr. Raymond Spenard, Project Officer, State University of New York, Albany, New York; Mr. Wendell C. Miller, Value Engineer, American Cyanamid Company, Bound Brook, New Jersey; Mr. Sol Mendelsohn and Mr. Art Dover of Industrial Value Services, Inc., Roslyn, New York; and Mr. Stanly Drozdal, Value Engineering Program Manager, Watervliet Arsenal, Watervliet, New York.

This Handbook was prepared by Technocopy, Inc., under subcontract to the Engineering Handbook Office of Duke University, prime contractor *to* the U. S. Army Materiel Command for the Engineering Design Handbook Series.

The Handbooks are readily available to all elements of AMC, including personnel and contractors having a need and/or requirement. The Army Materiel Command policy is to release these Engineering Design Handbooks to other DOD activities and their contractors and to other Government agencies in accordance with current Army Regulation 70-31, dated 9 September 1966. Procedures for acquiring these Handbooks follow:

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MR. LEHMAN
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Comments and suggestions on this handbook are welcome and should be addressed to Army Research Office-Durham, Box CM, Duke Station, Durham, North Carolina 27706.

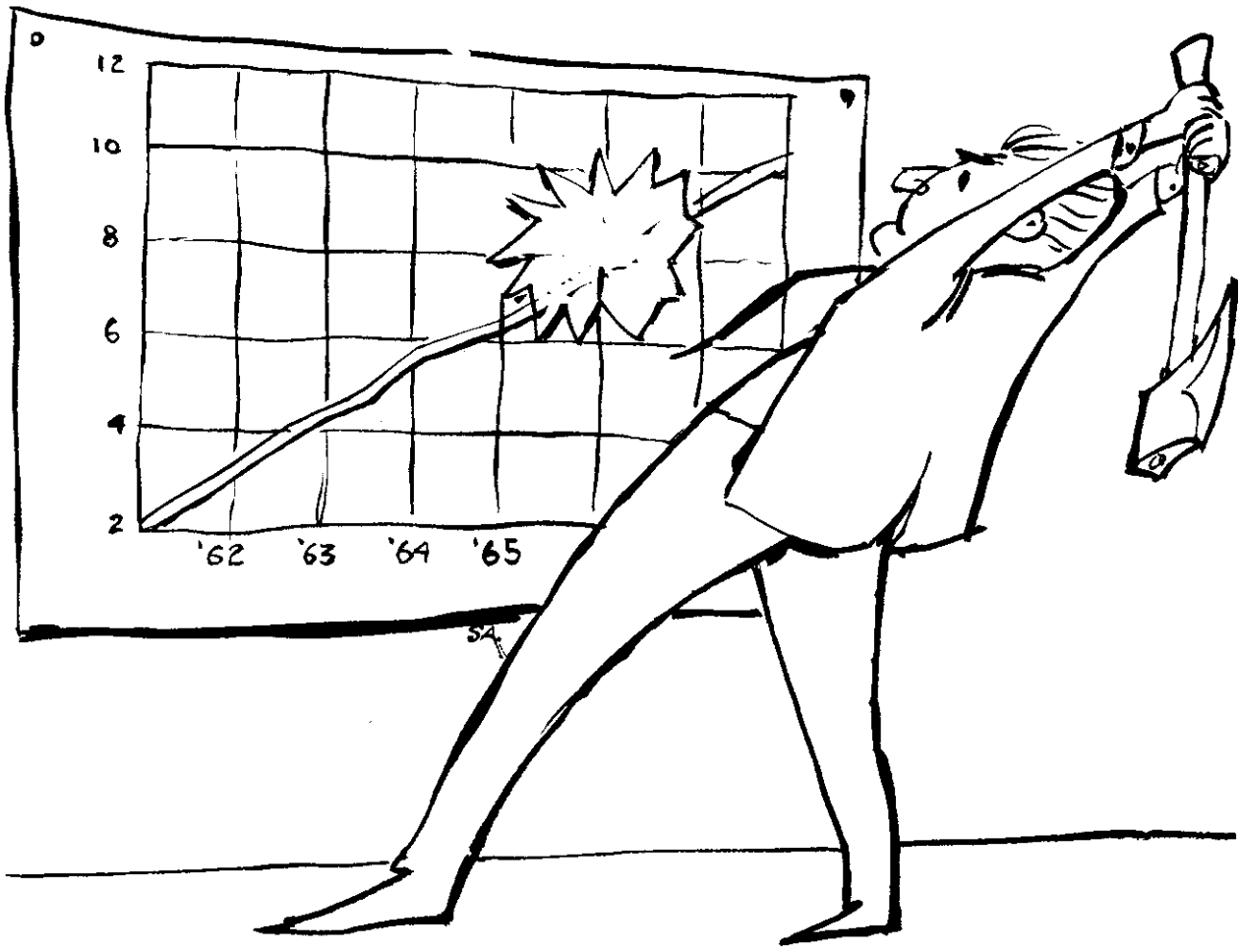

Figure 1-1. What's in a Name?

CHAPTER 1 WHAT IS VALUE ENGINEERING (VE) ?

1-1 WHAT IS IN A NAME?

By whatever name (and there have been many!) Value Engineering (VE) has produced a lasting and beneficial impact on the industrial/ military complex. Yet, VE in spite of its ability to produce benefits, also seems to be a technique capable of generating incongruities. For example, it is doubtful if any ...

1. Proposition ever offered management such spectacular economic gains, and yet, was so resisted as a management tool

2. Speculation ever showed such a return on investment but also entailed the risk of laying bare the company soul

3. Methodology ever held out such potential for improving the value of a product, and yet, if misunderstood, laid so many pitfalls for merely cheapening a product

4. Profession ever offered such opportunity for individual growth and recognition, and yet, also could provide such an enormous "goldbrick" wall behind which to hide

5. Discipline ever produced so many "overnight" experts and yet continued to thrive

6. New idea ever came so near drowning in a sea of semantics—and survived

7. Technique has been so ignorantly criticized and maligned, and yet, has created such a revolution in military procurement.

"You can assist us in buying only what is needed by critically appraising procurement specifications to identify both qualitative and quantitative requirements in excess of those needed to assure safe and reliable operation of military equipment. Some defense contractors now have formal value engineering programs and such contractors have been able to recommend hundreds of ideas to reduce costs of parts, components and end items by as much as 50 percent. I urge all contractors to stress such critical examinations and to propose cost savings ideas promptly to Defense officials."

—Secretary of Defense McNamara,
December **2, 1963**

So, it is apparent, that such a request to Defense contractors represents a revolution indeed. In years past, how many times did contractors see, over and over again, opportunities to change specifications and alter designs to not only reduce the cost of military equipment, but to improve its reliability in performance as well? But the red tape and resistance involved was just too much! Things have changed, now the Defense contractor is not only encouraged to make changes, but is offered as well, an attractive opportunity to share in those savings.

Therefore, many industries and companies both within and without the Defense complex have adopted this new technique as a very effective method for cutting costs. Some of these companies call it Value Engineering, and even others give the technique many other names. But the goals and principles were those born with the technique originally called Value Analysis—and still are, by whatever name.

1-2 IS IT NEW?

Chronologically speaking, Value Engineering cannot be considered new. It was first applied, under the title of Value Analysis, by Lawrence D. Miles, of General Electric, in 1947. In effect, Mr. Miles took an old attitude about the search for value, and developed from this attitude a successful methodology that would assure the development of value in a product. Therefore, in answer to the question "Is It New?", it might be said that value analysis/value engineering is based upon something old and something new—an old attitude and a new methodology.

It is because of this very two-pronged character of the technique, that the neophyte practioner of value engineering may often kill acceptance of the technique at the very outset. By presenting value engineering to the uninitiated as something entirely "new", the new practioner of the technique will intend to induce and encourage the very ignorant or premature judgment that he is trying to overcome. In other words, he will encourage resistance *to* change, which is symbolic of the very attitude value engineering must break down. As sure as only the "new" aspects of value engineering are used as arguments for selling the technique, as sure will the new practioner be of getting the classic roadblock reply: "We've been doing that all the

time!". Or the one cranking up his resistance to the "new" idea, is liable to come back with another classic roadblock remark: "I could do that too, if I had time!"

It is well to point out, that probably about **99%** of the people making the resistance remark, "I could do that if I had time"—are exactly right. They could! If we accept this statement as true, we face an inescapable conclusion—even more important than the technique itself—value engineering/value analysis creates a job or a team effort, whereby somebody has the time and management blessing to devote full efforts to the economic consideration of a product.

So to paraphrase the question in another way, and ask: "What's New?" we might say of value engineering "We have here a new technique based on an old attitude". We use the attitude every time we go shopping when we look for value. But value engineering provides an organized methodology for assuring that value is built into the product, and it assures that it is somebody's job to have the time and effort of getting that value to the product.

1-3 HOW IS IT DEFINED?

Value engineering is a questioning type of technique. So, to define and analyze VE, why not turn the VE approach on itself? The VE type of approach can be characterized by five questions:

1. What is it?
2. What does it do?
3. What does it cost?
4. What else will do the job?
5. What does that cost?

1-3.1 WHAT IS IT?

Value engineering is, in fundamental terms, an organized way of thinking. It involves an objective appraisal of functions performed by parts, components, products, equipment, procedures, services—anything, in short, that costs money. The VE approach is aimed at harvesting necessary function for lowest cost; it checks the upward spiral of costs, but locks all the essential product reliability, performance, and maintainability into the value engineered item.

Definitions for VE are numerous. Two are representative and are cited here—and for good reason. The first definition was selected because it is by Lawrence D. Miles, considered the father of value analysis/engineering. The second definition is quoted because it is a part of the Department of Defense (DOD) Armed Services Procurement Regulations ***(ASPR)*** and therefore represents the "target" definition for the largest organized VE effort in the country—military procurement.

Mr. Miles says: "Value Analysis is a philosophy implemented by the use of a specific set of techniques, a body of knowledge, and a group of leamed skills. It is an organized creative approach which has for its purpose the efficient identification of unnecessary cost, i.e., cost which provides neither quality nor use nor appearance nor customer features."

The ASPR definition states: "Value Engineering is an organized effort directed at analyzing the function of an item with the purpose of achieving the required function at the lowest overall cost."

In the late forties, Mr. Miles spawned a terrific cost-saving methodology. In fact, it is probably safe to say that VE is one of technology's most important contributions to business and industrial economics.

1-3.2 WHAT DOES IT DO?

To answer the question simply and directly, requires another definition—the most simple and direct definition we have found:

> "Value engineering is an organized, creative approach to the achievement of required function at the lowest cost."

VE is a methodology for relating product worth to product cost. VE is concerned with providing good value, at a fair profit, by investigating what the product does in relation to the money spent on it.

VE's primary, basic, and fundamental concem is with function. It is this approach to function that sets VE apart from all other cost-reduction techniques. Other techniques set out to save dollars; VE doesn't. When the function(s) of a product is scientifically analyzed by the VE methodology, the dollar savings are automatic—and are likely *to* be maximum.

That is what VE does.

1-3.3 WHAT DOES IT COST?

This is not important! ... and what discipline can make a statement like that?

The claim is validated by value engineering's overall record of performance. When intelligently applied, discreetly managed, and honestly reported; VE has removed 15 to 25 percent of manufacturing costs—including the costs of VE itself. Stated another way, the record shows that VE has produced a retum of anywhere from 2:1 to 20:1 on investment.

Cost? In today's market VE appears to he one of the soundest of economic ventures. At worst, break even is virtually assured. In the bargain, management stands to learn things about its organization that may never otherwise have been uncovered.

1-3.4 WHAT ELSE WILL DO THE JOB?

If we listen to all the negations, there appears to he a multitude of other "things" that *will* do the job and are ***already*** doing the job.

Before VE, there had always been ways of cutting costs. Perhaps the most widespread technique used through the years was to concentrate on the reduction of material and labor costs, which often resulted in the production of inferior products. Except for the most expendable of items, this approach has no place in our industrial or military systems. Value analysis never seeks such a solution.

1-3.5 WHAT DOES THAT COST?

It is claimed repeatedly that traditional types of cost improvement will remove just as high a percentage of cost from a product as does the application of value engineering. In many cases this may he true, hut the record for value engineering shows repeatedly that value engineering can remove an additional 10 to 20 percent of cost after the traditional methods have been applied. And further, the record for value engineering shows that, in addition to cost improvement, value engineering usually improves reliability and performance as well.

1-4 HOW DID IT START?

In 1947, one of the vice presidents at General Electric observed the occurrence of a rather unusual phenomenon that had been appearing throughout industry. Design engineers had been forced, by wartime shortages, to use substitute materials and designs. Sometimes the substitute just couldn't match the performance of the material it was replacing, hut not always. Very often the substitute was just as good; and occasionally it was even better, and surprisingly enough, lower in cost.

At General Electric, as at other large companies, top officials wondered if there could he a way to induce a higher frequency of such product efficiency by consciously developing substitute materials to take over the function of more costly standard materials. GE called in Lawrence D. Miles, a respected staff engineer, and put him to work on the problem.

Mr. Miles came up with a number of answers and ideas—hut principally an attitude—that greatly exceeded the scope of his assignment. A revolutionary management tool was being horn. Mr. Miles took his findings to Mr. Harry Erlicker, Vice-president in charge of Purchasing, and together they coined the name—Value Analysis. They had cornered an attitude that would blunt the attack of rising costs. After working out a generalized plan of procedure, Mr. Miles and a small staff of assistants set to work on the first actual value analysis project; they came up with production savings of more than $200,000 per annum, tuming a low-sales item into a tremendous commercial success.

Encouraged by such spectacular results, the General Electric value analysis staff was increased, and other problems were attacked with equal success. Their fame and function spread through GE, and gradually—by word of mouth and articles in trade journals—their techniques were brought to the attention of American industry. Thus, it was not long before many astute companies, who had been exploring for new methods of cutting costs, adopted the technique.

After seven years of widely publicized success in industry, value analysis began breaking into the military establishment. In 1954, surveys showed that the cost of ships to the Navy had more than doubled since the end of World War II. Something had to be done. Value analysis seemed a possible solution. Therefore, under the name of Value Engineering, value analysis rapidly became a way of life in the Navy. And within a few years, every large Navy installation

had its own value engineering department.

Value analysis joined the Army in 1955. In September of that year, the General Electric value engineering training program was brought to the attention of Watervliet Arsenal where steps were taken to initiate a value analysis program. Within a year, the Army's first value analysis activity was established at Watervliet Arsenal. It began on a limited scale, and the results of one value analysis year were so rewarding that a value analysis program was officialy established throughout what was then the Ordnance Corps. As a result of this program, several hundred value engineering projects were initiated, and the savings for accepted proposals were in the order of almost 1.4 million dollars. Also, as a result of this Watervliet Arsenal program, the first edition of this publication was produced, titled *"Value Analysis"*, ORDP 40-2.

The success of these programs in the military establishment attracted the attention of the Department of Defense, and consequently in 1963 DOD stipulated that contractual arrangement for the inclusion of value engineering requirements in all Department of Defense contracts was to be initiated. There can be no doubt about the success of value engineering in the Department of Defense. Beginning with fiscal year 1963 and through 1966 VE has shown an audited savings of over 1.1 billion dollars.

"Value engineering as a technique is not on trial. The achievements to date overwhelm many questions of the efficacy of the technique." This statement is quoted from the *Journal of Value Engineering*, First Quarter; 1965, as made by Mr. George E. Fouch, Deputy Assistant, Secretary of Defense for Equipment, Maintenance and Readiness.

VE is in DOD to stay!

1-5 HOW GOOD IS IT?

In fiscal years 1963 through 1966, VE has shown a cumulative audited savings of over 1.1 billion dollars for the Department of Defense. In every one of these four fiscal years the accomplished savings exceeded the goals of savings that had been established for those years. But do the advantages of applying VE stop with dollars saved? Indeed they do not. In a high percentage of value engineering proposals, surveys have indicated that there are collateral gains in such areas as reliability, maintainability, producibility, human factors, etc.

Any technique that can produce those kinds of results has got to be good.

1-6 WHAT IS DIFFERENT?

With this kind of success just cited for the application of value engineering, it seems inconceivable that we should still face a clash of philosophies in the cost improvement area. On the one side are all the conventional and traditional approaches to cost reduction—such as production engineering, tool engineering, industrial engineering, methods engineering, etc. The proponents of these approaches often advance the argument that there is really nothing different in value engineering. These claims are made because of the lack of understanding of what value engineering really is—or perhaps more properly, what value engineering isn't. All of the traditional approaches are methods centered; they center attention on the drawing of the part as it is and, therefore, set out to improve the part rather than to evaluate the function.

On the other hand, value engineering does not accept the designed product and its component part, but stresses cost reduction through defining the function of the product and redesigning the part accordingly to perform the function at the lowest possible cost. Therefore, value engineering challenges the very specification, design requirements, and the design itself. The value engineering approach therefore develops in personnel the motivation to creativity and cost consciousness—all to the economic gain of the organization that implements the technique.

VE stands apart and is different from conventional cbst cutting approaches because it combats two major causes of poor value—time and tradition. Time is that command to "Get the job done in a hurry, regardless....", overlooking value and function. Tradition is the voice of the past, decreeing that the job be done just as it was done yesterday, last year, or ten years ago—without any changes and improvement—an important sound that is often inaudible to the right people. These two factors feed the roots of interior functional value. They can be overcome by the creative techniques of value analysis.

The pressures of time, for example, are ever-present and very likely to be almost over-powering. No one in industry or the Armed Forces is ever given enough time for all the important projects; invariably the assignment is to get the job done. as soon as possible. In typical emergency tasks, there is seldom time to sit back and contemplate ideas, or to design for value—or even to wonder if there is a better way to do the whole job. People are generally pleased if they can get the job done in time; if they can save money for their organization in doing this, it is highly commendable. But rarely are they expected to be experts on alternative materials and new manufacturing processes; and if they are, it is even rarer that they are asked to submit their comments on the proposed design.

There are numerous examples of cases where time limitations and fear of criticism caused designers and engineers to overdesign products that were absolutely fail safe. If these products had been designed conservatively, with an ever watchful eye observing the relationship between function and value, untold savings might have been realized.

Tradition is the second enemy of good value. It is always easier to get an old idea from the files than it is to work up a new one. If a product has always been made to work a certain way, people will say, "If it worked for a similar item, it will work as well for this one". Or simply, "Why change it?" Well, you change it because tradition-oriented practices permit items with high costs and low use values to perpetuate themselves. You change it because unnecessarily close tolerances and overspecified finishes continuously boost prices—until an astute value analyst emerges to sweep away the hallowed dust of habit.

It must be comprehended, therefore, that VE is capable of producing a revolution in any organization. The results of that revolution can be highly beneficial, resulting in spectacular economic gain. But, the results can also he embarrassingly disruptive. Therefore, the management of any organization that is unwilling to handle a revolution, shouldn't start in the first place.

Value engineering is a potent management tool. It must be so understood and used—by management.

Figure 2-1. The Boss Is Always Wrong

CHAPTER 2 THE CHALLENGE OF VALUE ENGINEERING

2-1 ENCOURAGE OR REQUIRE?

In a sense, it could be said that the military establishment is challenging every contractor, as well as its own agencies, to make and save more money—and is offering help to do it! However, there are still skeptics, both within and without the military complex; perhaps this is healthy. American industry has continued to prosper and grow because, for one thing, it didn't embrace every panacea, program and technique that came along. Some have, and many have suffered thereby from cure-all programs thrown together in times of economic crises. Management cynicism is understandable.

But now comes the VE program by decree—at least for the major prime contractors to the DOD, involving as well, the multitude of subcontractors to the primes, and of course, all the military services with their complex of agencies. VE is in DOD to stay!

> "Provisions which encourage or require value engineering shall be incorporated in all contracts of sufficient size and duration to offer reasonable likelihood for cost reduction." (1-1701).

The quotation is from the DOD publication, titled, ***Value Engineering Contract Clauses, A Digest of Defense Procurement Circular Number 11.*** The "1-1701", refers to Part 17, Section I, of the ***Armed Services Procurement Regulations (ASPR),*** and, as any Govemment contractor knows, the ASPR makes it official!

The first ASPR coverage of VE appeared in the 1955 edition. In the interim, there has been much resistance, much negotiation, and much talk. VE has presented a challenge to the DOD/Industry complex. It is doubtful if any procurement policy has ever created such an impact. It is further doubtful if any procurement policy has ever offered the contractor such opportunities for profit improvement, or held out to the Government such potential for savings. As stated previously, the DOD audited net savings started with $72 million in fiscal year 1963 and increased to $495 million through fiscal year 1966. VE is indeed one of the major areas in the DOD cost reduction program.

But what of the contractor? In view of these spectacular savings, how has he fared? Many have done well. Many have, and are, showing up to 50% savings on their immediate contracts, and collateral or run-on benefits are even more enticing. Every effort is being made to be generous with the contractor—to offer him as much incentive as possible. Those two words in the ASPR, ***encourage*** and ***require,*** should be noted. It is likely that contractors operating under a required VE program, are reaping, even percentage wise, a larger return for their efforts. This should serve as a weathervane for the contractor who is being "encouraged" to implement a VE program. Either way, DOD knows that the market for potential savings is only scratched, and will therefore continue to encourage ***and*** require. But the ***encourage*** could become exclusively ***require.***

Therefore, those contractors in the ***encourage*** class, might do well to currently exercise their freedom of choice and carefully investigate just what value engineering is—and what it is not. A few of the advantages of this methodology are (or should be) immediately apparent. However, in view of the many questions asked daily about VE, it is all too evident that many are ready to judge the methodology from a basis of what they ***believe*** it to be, and not from a comprehensive understanding of ***what it really is.*** And those who could use it the most are the ones who seem to judge it the most!

An honest and unhurried evaluation of the challenge of VE could bring benefits and bring them earlier. Many others who were ready are glad they were. Quo vadis?

2-2 ACHIEVE OR MAKE?

Like any good problem-solving technique, VE is a challenging and searching methodology. It is forever forcing the VE practitioner to dig for fundamentals—to find the basic answer to what a part, product, system, or process is really intended to achieve. VE looks for the abstract

before it considers the concrete; it insists on a systematic determination of function for a product, before giving consideration to the materials for the product, or how the product is fabricated. This approach sets VE apart; it operates on an achieve philosophy. And when the methodology is dialectically pursued, no degradation, but rather improvement, of product usually occurs—and even more important, savings become essentially automatic. Such objectives cannot be honestly claimed for most cost-reduction approaches; they operate on a *make* philosophy. Often, lower quality—as well as cost—is the result.

It is understandable that there is resistance to a technique that represents a radical departure from the usual way of doing things. Management is quite naturally preoccupied with the strategy that has always produced successand profit: make it, test it, and get it out the door. Only then does "it" become billable—and a receivable. VE appears to be an added strategy that could retard the whole process. But because first appearances (and judgments) can be misleading, let us do a bit a reappraisal. **Is** the company out to achieve or make? Does it really understand what business **it** is in? No impertinence is intended!

For example, an ad appearing in the Wall Street Journal, June 6, 1967 shows the kind of searching questioning being discussed; it is an exposition of the thinking of the newly-elected president of the Chicago, Burlington, and Quincy railroad. In the ad, the prexy said:

> "Movies aren't in the movie business; they're in the entertainment business.
>
> "Magazines aren't in the print and ink and paper business; they're in the communications business."
>
> "We're not in the railroad business; we're in the distribution business.
>
> "Mere semantics?
>
> "No! Much more than that.
>
> "lt's an attitude which forces us to think of this railroad as an extension of the shipper's total distribution system.
>
> "Attitude and function—definitely channel thinking!"

Examples of the same kind of functional thinking appeared in the Society of American Value Engineers publication, ***S.A.V.E.*** Communications for November 1967:

> "You don't buy a newspaper—you buy news.
>
> You don't buy life insurance—you buy security for others.
>
> You don't buy glasses—you buy vision.
>
> You don't buy awnings—you buy shade."

Beginning to get the idea? Try this one:

> "What is a pencil for?"
>
> "Writing?"
>
> "No! Making marks!"

Here is another:

> "What is a Zippo lighter for?"
>
> "Lighting cigarettes?"
>
> "No! Producing heat"

As primerish and platitudinous as these examples may seem, they point the way to a searching identification of what a product really does—or even a business.

What is the basic company philosophy—make money, or achieve a function? It could be that more emphasis on the latter would produce greater amounts of the former!

2-3 TO BE OR NOT TO BE (in VE)

The Armed Services Procurement Regulation coverage of VE is offering the defense contractor great incentives "to be"; through it, the contractor can acquire as much as 75% of the VE savings created for any given system or product. And further, one of the factors being used to qualify DOD contractors is their management of successful VE programs. In terms of dollars, it gets even more interesting for the defense contractor. For example, one

contractor's Value Engineering Change Proposal (VECP) was approved for a savings of $2 million; the contractor's share was $600,000. Another contractor got a $360,000 share of a $900,000 saving, and still another contractor got a 50% piece of $314,000.

A consideration of some of the traditional "roadblock" questions employed—and usually ignorantly—as excuses for not practicing VE, may serve as guidelines in making the "to he" decision. At least a more favorable climate for VE acceptance may be created. That is the intent. Common "roadblocks" are:

1. *We are too small to practice VE.* Not so. The big companies have no monopoly on ideas, and this is what the defense contractor is rewarded for—creating cost saving ideas. In fact, through VE, the small contractor has a tremendous opportunity to improve his competitive position with the "bigs".

2. *Our product varies too much in size, quality, use, purpose and price range.* The record for VE disproves it. Any product presents a potential for savings through VE—and a better product often results.

3. *We buy a large percentage of the parts that go into our product. VE is not feasible in this type of operation.* That's what many people think, but they think it because they are not aware of the wide potential spectrum for the application of the VE methodology. In addition to design, the VE technique bas been very successfully applied to such operations as assembly, testing, inspection, and shipping. Further, VE work with vendors of parts has produced attractive savings for both vendor and buyer.

4. *Our company is involved in R & D, producing first-time, highly technical products. The production quantities required to realize the full potential of VE are not there.* It is true, VE may have limited application in such situations, but not because of quantity of production. The application of VE prior to the solving of performance problems may be premature. In spite of this seeming limitation, there are case histories documenting the fact that VE not only solved the technical performance problem, but met cost objectives as well.

5. *We are a service business; VE is for hardware.* Such is the uninformed (and erroneous) opinion of VE. But like any good problem-solving technique, the concept of VE lends itself to managerial decision making. Therefore, VE is being successfully applied to processes, procedures, and soft goods. The VE methodology also is finding its way into education, transportation, and Govemment. VE isn't for hardware only!

Like any managerial decision, the decision to be or not to be in VE, requires complete objectivity—a willingness to take an open-minded look at the technique, followed by a consideration of all the possible effects of implementing the methodology into the organization. All of which is platitudinous advice to any competent member of management. But to stretch the presumption further, why not ...

1. Ask your auditor or financial people to take a look. If defense contracting is involved, an analysis of the VE ASPR's could point up the potential for return.

2. Ask the customer how he feels about the "value" of your products. He will tell you candidly-and often supply the direction for improvement.

3. Ask a VE consultant to do a trial run on your product line. If he is a real professional, it won't cost much for him to come up with convincing evidence of the potential for the application of VE in your operation. If the evidence is bona fide, he won't hesitate to assure you a 10:1 return on investment.

4. If you're already a defense contractor, there are any number of opportunities for orientation, training, and guidance in the application of VE—and usually it is free! Train some qualified personnel and make a trial run. If you never apply VE, there are some very helpful collateral benefits to he derived from this training. If the training is comprehensive, the personnel involved will at least get exposure in three important areas—communications, creativity, and cost consciousness—all of which are problem areas for industry.

VE is a good speculation, but like any speculation offering a high return, there are risks. VE, when properly endorsed, continuously supported, and vigorously implemented by management, can start a *product-people* revolution—from top to bottom. Management must be prepared to control the revolution. When it does, the upheaval can be diverted into a money-making revolution!

Figure 3-1. In Strict Accordance With Instructions

CHAPTER 3 ORGANIZING FOR VALUE ENGINEERING

3-1 A WORD OF ADMONISHMENT

If the word in the first two Chapters of this hook has come through, there should at least be interest in the potential that VE offers for profit improvement. But a word of admonishment may also be in order. VE is a potent potion. Like the wonder drugs, it does indeed produce some wondrous cures. But also, like the wonder drugs, VE should be administered only in strict accordance with directions . . . where the complete background of the patient is fully known . . . and, after alerting the patient to the possible side effects.

It could very well be that the patient (your company) is not aware that he is suffering from the malady of the value problem in his products, processes, services—or whatever. He may not be aware that his output includes a multitude of unnecessary costs. Perhaps it doesn't. But if it doesn't, his case is the exception rather than the rule. The record for VE shows that immunity to the malady is rare indeed—and an acceptable profit picture doesn't necessarily prove the absence of infection. Even the curing of a mild case can raise the profit margin to a level well in excess of acceptable.

But before taking the cure, the word is still—caution, proceed slowly. Here is one of the most important characteristics of the VE treatment: in preparation, the patient cannot only perform self diagnosis, but can also administer the treatment in small doses prior to all-out commitment. But there must be a pre-understanding of the possible side effects, and the patient must be prepared to cope with those effects. When so prepared, the dosage can be increased accordingly. When once convinced that the VE treatment works, it may be advisable to retain professional services for continued or extensive application of VE. Under the guidance of the VE specialist, the return on investment in the treatment is likely to be not only faster, but greater. But equally important, the specialist is well prepared to anticipate the side effects and allay fears accordingly—at both management and worker levels.

3-2 THE VALUE PROBLEM

As part of the self-diagnosis in arriving at the decision whether or not to try VE, there should be an understanding of the value problem. In general, there are two factors that contribute to the problem—the technical and the human. Both factors generate unnecessary costs and, therefore, obstruct the achievement of value.

Consider, even briefly, the technical factor in the production of an end item or a part: the cost of that part is made up of a particular selected combination of materials, designs, methods, and manufacturing processes. Suppose that only three different approaches are available in each of these four areas. There would be 81 possible combinations from which to choose. But even more reasonably, assume that there are six possible choices in each of the areas—all of which results in 1296 possible combinations. When we consider that this multiplicity of choice could represent only one part in a complex product, the number of possible combinations becomes staggering. In such a situation—one that must occur daily throughout the industrial complex, who can say that the product, or even the part, is being put together in the manner that eliminates the greatest possible amount of unnecessary costs? Neither can VE guarantee the ultimate in the elimination of unnecessary costs, and the achievement of unqualified value. But VE does represent an organized approach to better value—and profits.

Now consider the human factor, and its bearing on the achievement of value. Psychologists tell us that desire and fear are the two great motivators of us human beings—the desire for personal prestige, and fear of personal loss. Both can throw great roadblocks in the way of the innovations that must occur in achieving greater value. The very success of VE can well hinge on effective and expeditious communications. But as any member of management knows, communication is one of management's biggest and most costly problem areas. Why? Because of fear or desire, people communicate (particularly on paper) to impress,

not to *express*—to do and say those things that will please the boss. Usually, communications so motivated tend to perpetuate inefficiency and high costs.

Another human trait, so evident in industry and business, is resistance to change. Because change, improvement, and innovation are the very essence of the VE methodology, the benefits to be derived from VE can be severely stifled unless this trait is understood and deftly negated.

At this point, it might be anticipated that VE is about ready to be presented as the panacea for all the ills, costs and human, that beset industry and erode its profit picture. This is not the intent. However, the various elements of the VE methodology have been developed to the point where they are successfully coping with both the technical and the human problems behind unnecessary costs and poor value. This success is predominately evident in the human relations area. This is fortunate, because success in VE must be spawned by the willingness of people to play the human behavior game in accordance with a new set of incentives. It can be done, and is being done. Here is why.

Psychologists also tell **us** that we very much want to feel that we are an important part of an operation, particularly that activity by which we earn our living. We want to "belong" by contributing something, and usually in a creative sort of way. Any competent management consultant will readily agree that the satisfaction the employee gets from knowing what is going on, and that he is making a worthwhile contribution to those goings-on, is often **as** important to the employee as the amount of compensation he receives.

Training in the elements of VE prepares personnel to cope with both the technical and human factors that contribute to unnecessary costs. Therefore, even the exposure of personnel to the VE philosophy and methodology can bring about a cost consciousness and satisfaction in the job, that represents side benefits —— hether or not an all out VE program is implemented.

3-3 THE VE SIDE BENEFITS

Industrial specialization has brought great benefits but it has also brought problems, particularly in the dispersion of authority. A product may be conceived in research, refined in design, further developed in engineering, altered by methods, assembled and produced by manufacturing, tested by quality assurance, priced by accounting, sold by marketing, serviced in the field . . . etc. Through this whole chain, two weaknesses usually loom large: product cost responsibility and communications. Each department contributes to costs-and usually with very little awareness of the overall effects. The lines of communication seldom provide for the expeditious flow of information, either forward or feed-back, that is *so* essential to the key decision maker in really knowing what costs are.

At this point, the question might reasonably be asked: "Can VE act **as** a cure-all, for improving cost responsibility and communications through this whole chain? The answer is, "No"; hut VE training does create an awareness of these problems.

As mentioned earlier, VE is a questioning and prodding methodology that searches for true function—and the cost of the alternate ways of attaining that function. Training in this methodology serves to alter attitudes toward costs with the possibility of substantial improvement in the value skill of key decision makers. However, if the VE training is comprehensive, all who take it will benefit. They will, in effect, be introduced to the importance of the "three C's" of VE: costs, creativity, and communication. They will be shown the logic of the functional approach to cost reduction and what a far-reaching effect this approach can possibly have on performance, as well as on the reliability of a product. Trainees will be exposed to the fundamentals of creativity and how to develop and use this quality in attaining the on-the-job satisfaction that is ***so*** important to everyone. They will be instructed in the process of communication and in the application of the techniques so vital to the improvement of writing **skills.** (Because of the particular importance of effective technical communications in VE, a Chapter of this book is devoted to the subject.)

It should be evident, therefore, that training in the elements of the VE methodology can result in very helpful side benefits to any company that provides this training for its personnel. Those benefits could produce a leavening

process that will permeate the whole organization—whether or not a company-wide VE program is adopted. But again—a word of admonishment: without the full backing of management, even trial runs on the VE methodology can prove to be not only ineffective but organizationally upsetting as well. It is therefore recommended that, prior to the adoption of an all out program, there be a thorough pre-VE survey, including a check on the possible center of gravity in the company and a sampling of VE training.

3-4 PRE-VE SURVEY

Before making the decision to install a Value Program, management should make a thorough survey and study of its business, the product it produces or the services it offers. Such a study, including anticipation of the many upheavals that the Value Program may cause, will do much to assure maximum benefits from the application of VE. Any concern that doesn't have an organized approach to cost reduction, would do well to investigate the opportunities that VE can offer. However, as a prelude to even a pre-VE survey or study, a consideration by management of the following true-false statements may help to alleviate management apprehension and establish whether or not "VE is for me".

VE TRUE-FALSE QUESTIONS

T—F: We have an organized approacn to cost effectiveness.

T—F: We are purchasing as many "standard" parts as possible.

T—F: We know thoroughly the true function of every part we design.

T—F: We have asked our customers about the "value" of our products.

T—F: Our engineering staff has the time and ability to consider the economic factors of a design.

T—F: We have asked our specialty vendors for their help and guidance.

T—F: We are providing our designers with a source for keeping them on top of the state-of-the-art in technology and materials.

T—F: Our designers are not "creating" something that already exists.

T—F: Our present cost reduction programs assure approximately a 10:1 return on investment.

T—F: Our cost programs usually assure collateral benefits for our products such as increased performance and reliability.

T—F: Because product cost has been an important consideration in all our departments, we don't need VE.

T—F: Ours is a service type business therefore VE is not applicable.

T—F: VE is not adaptable to our products because they are not produced in large quantities.

T—F: It is not feasible to attempt VE on products of unusual technical complexity.

T—F: VE is not effective where a large percentage of parts for a product are purchased.

T—F: The small company cannot afford to apply VE.

T—F: VE is a panacea for all of a company's economic problems.

T—F: Any methodology worth its salt will create very helpful collateral benefits.

T—F: Our people write clear and readable reports.

T—F: Most of our professional personnel have "satisfaction factors" built into their positions.

T—F: We are providing opportunities for our designers to learn and practice creativity,

T—F: Our company is too big; the application of VE would be cumbersome and impractical.

T—F: The application of VE to our products is too risky; there is too much chance of degrading quality and reliability.

T—F: Reliable cost data are readily available in our company.

T—F: Ours is a process business—VE won't work.

There are 25 true-false statements (four points each for each correct answer). For most concerns, every statement should be answered "false", and if so, that concern could expect a very gratifying return from the application of VE.

Having decided that VE will work in the concern, we must next consider the question of "where" in the organization VE can find its most effective center of gravity. This center will, of course, vary from company to company in accordance with conditions in a particular company. However, in determining the organizational fit for the value engineering group, it should be remembered that VE is being installed for the overall benefit of the company, and not to the sole benefit of any one department. Criteria for the organizational placement of VE should hinge on the role a department plays in the major decisions of the company, which in turn is a reflection of the nature of the business. If a business is engaged in a product line, or a service, involved in principally purchased parts, with very little design change from year to year, then the company would likely receive the greater benefit by fitting VE into the purchasing department. Businesses specializing in the design and development of complex or highly technical hardware with frequent design changes, and involving a high percentage of technological skill, should, without question, locate VE in the engineering or technical department. In businesses where a substantial percentage of product value is represented by the cost of shop labor and facilities, then VE should likely be located in the manufacturing department.

Other than departmental considerations for location of VE effort, many other factors are involved. Only a careful analysis will bring all the factors to light—particularly those uncovering the location where VE is most likely to gain ready acceptance and, therefore, successful development.

Also, the survey and study must give careful consideration to whether VE is to function as a centralized or decentralized operation. A centralized group has the advantage of crossing functional departmental lines, where it can execute coordinated efforts, and become an established entity. However, the centralized approach entails risks; it may gravitate out of the stream of day-to-day events to the role of "come and see me" consultants—out of the communications loop of the decision makers. Good proposals are no good if they are late! Decentralized VE effort has its advantages. Here the VE specialist is in intimate contact with daily problems and the people who have them. His role for giving aid is much more easily developed; he is in a better position to create the rapport and respect so essential to the success of VE.

Surveys have indicated that in smaller firms, it is almost a 50-50 chance between centralized and decentralized VE effort. Larger firms lean toward centralized VE groups by almost 2 to 1 over those with decentralized groups. In either group, the level of reporting is extremely important; it must he placed high enough to command respect, and reach down low enough to deal with value problems on an eyeball-to-eyeball basis.

One of the most important aspects of preparing for VE, is the way in which training in VE is to he given. Retaining the services of outside professionals represents, of course, the greatest initial investment. But, this approach to the problem probably also buys the greatest amount of insurance against a minimum of upheaval and for a maximum of success. There are many opportunities, particularly for Department of Defense contractors, to get training for their personnel through seminars and Government sponsored programs. However, the do-it-yourself approach can be risky; there is liable to be just enough knowledge to be dangerous. Remember, VE is a potent potion. Its power must be understood, applied deftly, and monitored meticulously—by management.

Figure 4-1. Value by Decree

CHAPTER 4 APPLYING VALUE ENGINEERING

4-1 THE IMPLICATIONS FOR MANAGEMENT

If VE is to be a success in your company, management must do more than just implicate itself; value must become a philosophy—a way of life; then, value must become an established objective; and last, the embracing of value as a philosophy and an objective must be forcibly established as company policy—preferably by decree. Management must unhesitatingly subscribe to the value engineering creed for management (par. 4-1.6)—and believe in it!

4-1.1 VALUE—A PHILOSOPHY

If the concept of value is to stand up and provide a base for a philosophy of operation, particularly in business or industry, it becomes necessary to define the term ualue. If you were to ask a dozen different people for a definition of the word "value" you would very likely get a dozen different answers. Let us therefore look at what are considered some authoritative definitions of value. The Random *House* Dictionary gives 16 different definitions for the word value when used as a noun. One of these definitions is particularly noteworthy for our purpose; it reads: "Monetary or material worth, as in commerce or trade". Roget's Thesaurus indicates ualue as: "A synonym for worth". Karl Marx, in his writings has stated "Nothing can have value without being an object of utility". L. D. Miles, considered the founder of value analysis/engineering, defines this all important word as: "Value is the lowest price you must pay *to* provide a realiable function or service".

It would appear then, even from these fragmentary citings of definitions, that value can represent a rather abstract idea. But value engineering, if it is to be a workable methodology, cannot be based on an abstraction. "To provide a reliable function or service", value engineering defines four types of value:

1. Exchange Value
2. Cost Value
3. Esteem Value
4. Use Value

In value engineering, the consideration of these types of value permits the value engineer to quantify the elements of product cost as they relate to value. The concept of value, therefore, to the value engineer is quite different from the concept of value to an old world clockmaker, a Fifth Avenue furrier, or a wealthy art dealer. Value, to the skilled craftsman, is cost ualue-the total cost of his product in materials and labor. If he is truly a skilled clockmaker, and has used only the best materials to assemble his handcrafted watches, the cost of his product is likely to be high. It will certainly be higher than the cost of the finest mass-produced electric clock on the market.

Value to the elite furrier, is exchange ualue, based on the abstract ,whims of fashion. It is value that is almost unrelated to the primary function of clothing—providing warmth and protection. The furrier finds, more often than not, that mink sells for more than raccoon; and some years marten will outsell beaver. Occasionally, supply and demand cause reversals, but never to the extent of upsetting the pattern of exchange value.

Value to the selective art dealer, is esteem ualue, based on the even more abstract dictates of how critics feel about art. Today, a Van Gogh original is worth many thousands of dollars; a reproduction of the same painting or the original work of an unknown artist, are worth practically nothing on the large scale art market.

The value analyst is relatively unconcerned with these three species of value. For his professional purposes, any item that will deliver basic function for the lowest cost, will be the item of his choice. An electric clock that keeps correct time is a better value than a costly handcrafted watch: a raccoon coat is better value than mink, if it will keep the cold out as well; and the work of a talented unknown, or a first-rate photographic reproduction, will have decorative aesthetic value equal to a Van Gogh original. This kind of value is known as *use* value—the cost of satisfactory and reliable performance of function by a particular item. (The stress is on reliable performance. A gallon of lubricating oil can be carried, from the motor pool to a truck, in an ordinary paper bag; but you would scarcely want to rely on it!) Use

value differs from all other kinds of value in two fundamental respects: (1) It is determined objectively. It has nothing to do with how people feel about an item; often it is not even concerned with bow much it costs to make the item. (2) The highest use value has the lowest price tag; it is the relationship between the actual cost of an item and the lowest price that must be paid for the item to perform reliably.

Ordinarily, when we discuss the price or cost of an object, the dollar figure to which we refer usually contains elements of all four types of value. But as already stated, the value engineer defines value in terms of use only. He, therefore, makes use value the basis for his analysis. Having determined the cost of use value, the value engineer is in a position to allocate the cost of other types of value, and, therefore, make a judgment as to whether or not the observed proportions appear to be reasonable. The segregation, by the value engineer, of the cost of use value, implies that the value of an object is a finite quantity. But is it, and if it is a finite quantity, is this the same as price? We don't always get what we pay for. If we are the purchaser, value is the lowest price which we must pay to fulfill our need. As the purchaser the price you pay represents the amount of personal resources you are willing to transfer to attain ownership of the object.

With all of this in mind, we see that in the purchase of such an everyday item as a pencil, that neither the lowest nor the highest price for the pencil necessarily offers the best value. The pencil that makes the most marks per dollar is the best value. Cost is the amount of work and material that go into producing an item. All of this work and material is not always essential to the function of the item; but, this work and material always contribute to the cost of the item. Therefore, if you are a producer, value is the lowest cost at which you can produce a given function.

However, value cannot be obtained by merely cutting costs. If, for example, you were the manufacturer of lead pencils, you could cut your cost considerably by placing the lowest-priced graphite in the lowest-priced wooden holder. The chances are you wouldn't sell many pencils! And thereby one of the greatest fears of industry is pointed up—the degradation of quality and reliability as a result of indiscriminate cost cutting. The proper understanding of the philosophy of VE, and its application through a disciplined methodology, will not permit this kind of product degradation. But unfortunately, for the good name of VE in general, there have been notorious misapplications of what has been called VE. For example, a manufacturer of television sets fell into the trap of merely substituting a cheaper part; he used paper capacitors instead of more expensive and reliable types.

Industry is beginning to rediscover what its best businessmen have known all along—that quality sells goods better than price alone. Value cannot be obtained by reducing quality or reliability; both are very important value features of an item or a product. And, neither can safety, appearance, reliability, or maintainability be sacrificed. Therefore, value can be truly attained only when the cost of all these features is brought into balance with the cost of attaining the essential function of the product. This is the basic philosophy for the successful application of VE.

4-1.2 VALUE—AN OBJECTIVE

For management to be in agreement with the philosophy of VE is a step in the right direction, and is certainly the first hurdle to clear. But this is not enough. If management is still harboring any apprehensions about the application and possible efficacy of value engineering in its own company, these apprehensions must be routed out before value engineering is tried. To attempt putting the philosophies of value engineering into practice without having full faith in these philosophies is like the hypocritical religionist: he goes to church on Sunday and gives all the appearance of subscribing to and embracing his particular religious precepts, but on Monday, when he comes face to face with the challenging problems of the day, he forgets or refuses to believe that his precepts might just work in business. So it is with VE. Management must be absolutely sold on the concept that value is both desirable and attainable.

After management is aware of the dangers of malpractice in VE (Chapter 3); has performed the suggested survey and, as a result, is ready to try applying value engineering; a big part of the battle is over. Management is then ready to set

itself on the road to reaping the benefits that have made VE famous. Remember, those benefits are well worth reaching for: value engineering has been able to return 10:1 for every dollar invested in VE, even where traditional cost reduction methods have taken out all the costs they can get out. But to realize these kinds of benefits, VE must become an all out objective for your company. You are ready to do just what the term implies—engineer value into your product, service, or activity.

However, members of management are still likely to ask, "Why all this fuss about value? We're showing a pretty good return on our operation. Under these circumstances, is it possible that we are tolerating an appreciable amount of poor value in our operation?" The answer to these questions is "Yes". The record shows that every product, service, or activity has areas which represent poor value (areas of potential cost improvement)—areas which are built in by hundreds of decisions made during the life cycle of the product, service, or activity. The principal reason for poor value is the lack of *an* organized effort to obtain high value. The essential objective of a VE program is to supply the organized effort that will result in the attainment of high value.

Without an organized counteroffensive to eliminate factors such as the following, poor value develops in many ways:

1. Temporary decisions. These are the kind that are made under the pressure of meeting tight schedules. Long after the condition that spawned the decision, the results of these decisions continue fostering nonfunctioning, unnecessary costs. An effective VE program, through its regular reviews, uncovers and eliminates the cause of these poor-value decisions.

2. Lack *of* essential information. This deficiency, which is present much more often than management would like to believe, leads to decisions based on honest hut wrong beliefs. For this very reason, the VE spends much of his time developing information that will lead in only one direction—to accurate decision.

3. Nongeneration of ideas. High costs of items are often perpetuated because of the lack of the ideas that would produce the item at a lower cost. VE recognizes the need to organize for producing ideas, and comes up with the methodology that will encourage the generation of ideas.

4. Personal *inertia.* Too often this inertia exists at the decision making level and thereby feeds unknown amounts of poor value into the unnecessary-cost hopper. Many decisions are based on long established habits built into company procedures . . . methods . . . tooling concepts . . . supplier relationships . . . etc. VE insists on the revolution that breaks this inertia.

5. Nontroublesome items. Too often, these "no-sweat" items hide high costs. The VE program provides a systematic method for analyzing the cost of any item, whether it he troublesome or nontrouhlesome, and thereby uncovers areas for potential cost improvement.

6. Pre-determined reactions Attitudes are inclined to become habitual and static; there is always a tendency to resist change. Every day we hear expressions which are symbolic of static attitudes: "Why change?" . . . "Don't rock the boat" . . . "Let's not make waves" . . . "We've tried that before" . . . "Don't change; we're too far into the contract" . . . "Not now, later". VE refers to these attitudes as roadblocks and takes steps—hut ever so diplomatically, to change attitudes and obliterate the roadblocks.

7. Reluctance *to* seek aduice. Far too often, management (and technical personnel) are determined to make everyone's decision for him; seeking advice seems to he considered a sign of weakness. VE inculcates the very concept of advice-seeking and thereby turns a so-called weakness into a tremendous asset.

4-1.3 VALUE—A POLICY

"Function for the lowest possible cost" will never be attained, and the value of VE will never be realized, unless management establishes and implements a clear and inescapable VE policy, There are many policy facets to he covered. The approach to these facets will vary with the company and its products or services. But certain policy points are basic: there must be goals; the involvement of the decision makers must be unequivocally evident; and, an environment for creativity must he created.

4-1.4 GOALS

Personnel who will he responsible for the execution of the value program must be given

goals. These goals should not necessarily represent a quantitative requirement. In most cases they cannot. Therefore, the targets must be somewhat arbitrary, representing a company objective to assure management that, in some specified period, value personnel have something to shoot at. Without such targets, the value program may be govemed by little more than chance. The following list is offered as a guide; management can fill in the target quantities with figures appropriate to its operation:

1. Train: ( )people
2. *Place:* ( ) active members on ( ) industrial or professional committees
3. Conduct; ( ) symposia for ( ) suppliers and subcontractors
4. *Deliver:* at least a ( ) hour VE presentation to management, including the president and his staff
5. *Stuff;* ( ) areas of the company with named value personnel
6. Organize: ( ) task forces to search out high-cost areas and
7. Attend: at least ( ) seminars given by other companies—and retum the favor
8. Motiuate: the practice of VE by news letters, posters, lectures, displays, and movies
9. *Develop:* at least ( ) new technique(s) in VE

4-1.5 MANAGEMENT MUST BE HEARD, SEEN, AND BELIEVED

VE policy statements from the top, must be heard—and emphatic ally-throughout the organization. The need for such statements cannot be overemphasized. Unless policy is documented and communicated early in the program, problems on such questions as budget, training, assignment of responsibility, and development of projects, will continue to arise and plague VE personnel. Therefore, management effort directed toward a careful and comprehensive formulation of policy will avoid many potential roadblocks to what could otherwise be a very profitable VE program. Quite obviously, no single statement of policy will be applicable to every organization, but, having made the decision on a VE program, management should get a policy statement circulated as soon as possible. Fast action will possibly pre-empt the grapevine rumors that could develop unreceptive attitudes—even before the program has a chance of getting off the ground.

Therefore, the following policy statement is suggested as a "starter" guide; it is not cluttered with detail and clearly implies that subsequent statements will be issued to complete the implementation:

> "It shall be the policy of the company to establish VE programs in each division, operation, and plant as applicable.
> "The essential elements of these programs are
> - "The establishment of suitable positions with functional responsibility to administer and carry out VE profit-improvement activities.
> - "The selection and appointment of qualified personnel to serve as administrators and specialists in the VE Program.
> - "The initiation of broad educational programs to familiarize all decision-making personnel with VE techniques.
> - "The establishment and implementation of procedures and controls to minimize all unnecessary product costs."

Management personnel must do more than be "heard" through issuance of policy statements; these personnel must be "seen" as well. Every time a VE seminar is held, a symposium is presented, a display is opened, a training program is begun—wherever and however VE activities are occurring—top management personnel should be very much in evidence. There is nothing that will so convince the lower echelons of the decision maker's true intent, than to actually see top management participating in VE activities. But—and this is imperative—these management attendees must be well informed on the VE philosophy and potential. They must, of themselves, be "believers", and with an unfeigned, contagious display of enthusiasm. Management that is only paying lip service to VE had best avoid contact with potential converts to VE. The salesman must be sold on his product! If management will keep in mind the potential that a well-organized

and supervised VE program can return—at least 10:1 for every dollar invested—heing sold and staying sold, will not he difficult.

Organizing for creativity often presents to "hardhitten" management, what appears to he a very nebulous and abstract process. Yet, this process is such an essential factor in the VE methodology, that to avoid it and its implications, is to dilute the very life blood of the methodology. The creative process in human beings is greatly misunderstood. By accepting popular statements about the process, it is much easier to be informed—and erroneously!- on the limitations imposed on the process, than it is to be informed how the process can he put to work. For example, nearly everyone believes that creative persons are born, or that the process only comes about by inspiration. Thomas Edison squelched both misconceptions when he said, "Genius is ten percent inspiration and ninety percent perspiration". This great man, in effect, set the theme for VE when he stated, "There's a way to do it better ...find it."

To do it better, the VE methodology first uncovers the true function of a part, activity, or service, then generates alternate ways to perform the required function. Therein lies two steps in creativity: determining true function, and generating alternate ways. Management must he willing to encourage the creative atmosphere that will permit these two steps to he taken. Management often argues that company structure and organization is already providing such an atmosphere through their research laboratories and design departments. However, there is a difference: laboratory researchers are not necessarily charged with the responsibility to include value in their searches for "a way"; and designers seldom have the time to consider economic factors. Too often, the designer's biggest worry is to "make it work, and get it out the door".

VE fills the gap. Its methodology can not only put a price tag on the researchers' "way", hut can also provide the designer with a service function that will give the designer answers on economic factors. What is the possible result? Products and services that not only work better, hut are likely to get out the door faster.

4-1.6 THE VE CREED

When management truly believes that value can he engineered into products and services, then management will he willing to "sign off" on the concepts expressed in the following VE creed:

1. Insist that everyone can do a much better job.
2. Understand that VE work is "people" work, and average people working together accomplish more than average results.
3. Comprehend that value is unquestionably related to function.
4. Organize to obtain the optimum relationship of value to function, through creative thinking and team work.
5. Design a program to follow the proved VE methodology in order to realize the full potential.
6. Submit to change, which is the price of progress, and realize that VE is ready to start when someone says, "Leave it alone; it works."
7. *Give* credit where credit is due and believe that there is no limit to what can he accomplished if it does not matter who gets the credit.

4-2 PERSONNEL—SELECTION, TRAINING AND BRIEFING

The verbs used to open each of the eight points of the VE Management Creed (par. 4-1.6) can also serve (hut with different connotations) as the cardinal "compass" points for the training of value engineers. If the training is effective, all who have taken it must assume responsibility for:

1. Insisting, and being ready to prove, that VE is a workable and practical methodology, capable of retuming at least $10.00 for every $1.00 invested in its application.
2. Understanding that his tasks, and the demands on him, will not he easy—particularly in the beginning.
3. Comprehending that, when VE is properly instituted and implemented, his efforts as a service function, can result in overall, long-range benefits for his company—far exceeding the cost savings resulting from his initial efforts.
4. Organizing people to communicate and work together as a team-and then lead them.
5. Designing a customized VE program that will work for, and in, his company—not merely parroting an approach that has worked somewhere else.

6. *Submitting* to criticism, but with the equanimity of a diplomat, always watching for the opening to reverse the criticism and make the point.

7. *Giving* of himself, hut never directly seeking credit for himself.

These qualifications, wrapped up in one individual represent quite a personality package. It could be said that the effective value engineer must b e a n expert on value ... hardshelled ... visionary ... a leader ... an expert communicator, on paper and on his feet ... an organizer ... unselfish ... creative ingenious ... resourceful ... brilliant ... imaginative ... clever ... etc.—if any more adjectives could possibly he applicable to any single human being! To sum up the point, the president of a prominent firm once said, after hearing his staff assistant expound the necessary virtues of the "good" value engineer: "Holy mackerel; he must be after my job!"

4-2.1 SELECTION OF PERSONNEL

Now comes the necessity for answering the "who" and "how" questions of training for the practice of VE. Obviously, determining *who* to train is much more difficult than determining *how* to train.

It has been said that the average person takes seven years to accept a new idea, no matter how much substantiation the new idea may have received. This kind of reluctance carries over into the nonacceptance of new advisory groups; it takes years to get people to ask such a group for help. No VE program can afford to wait that long! Therefore, the chances for getting a successful VE program under way quickly will be greatly enhanced if the man chosen to be the top value engineer is a man everyone in the organization already respects. For this reason, he should be chosen from an organizational level as high as possible. then of course, come the arguments: "He's too valuable; can't afford to move" . . . "We'll disrupt the whole structure" . . . "Who will replace him?" . . . etc. If and when this happens, ask yourself: "Does this man in his present position, offer to the company a potential of a 10:1 return on his time or his efforts?" In VE he will likely do even better. Without respect as a "starter" qualification, the wrong leaders will he detrimental to the work and accomplishments of any group doing any kind of work. But in VE, the wrong personnel can be absolutely fatal to the program.

Although technical capability, experience, and respect are essential qualifications; these alone will not make personnel "right" for VE. Remember too, that the value engineer will he serving in a consulting capacity—a role not easily handled by a young man, or even a man too youthful in appearance. Regardless of background, experience, and the respect these qualities may engender; the VE nominee must exude the conviction that VE is the last word—worthy of a career, not just one more training program. Without reflecting this conviction to all with whom he comes in contact, the nominee cannot succeed. Further, as though the qualifications were not already severe enough to eliminate all but "superman", our nominee must he gregarious, have imagination, and display initiative. He must enjoy working with people, because he will he in a ***people*** business; it is people who initiate changes, implement changes, and—most of all—resist changes. He must be imaginative because this quality is the basis of creativity, without which he will he unable to visualize the numerous possible solutions to a problem. He must be a self-starter with plenty of initiative and integrity; in VE he creates his own work—and problems—hen sets out to solve them. Without doing so, he is not a value engineer.

4-2.2 TRAINING OF THE VALUE ENGINEER

Training is moving up—in a dual way. Not many years ago, *training* in business and industry, connoted instruction for those at apprentice or manual worker level. This is no longer true. As any perceptive business man knows, a casual perusal of almost any newspaper will reveal articles on the training being offered to executives on a wide range of topics—verything from industrial psychology to why a housewife likes a pink refrigerator instead of a white one. This broad spectrum of training is originating from a very broad base of offerors—-from the manufacturers of products to the most elite universities in the country. Training of itself is becoming big business. In doing so the duality of the upward move is evident: upward from "indians" to "chiefs"; and

upward in content of training from the manual to the intellectual.

Further, the astute business man knows at least some of the "whys" behind these training trends: contemporary advances and forced specialization in the sciences and all branches of technology preclude the possibility that anyone can any longer he a jack-of-all-trades–even for purposes of administration and supervision; and further, because of the increasing importance of the human relations factor in business (that is, in the successful business!) the progressive executive is expected to be up on his psychology—and even philosophy. Executive background demands have moved from hardware to software, and from manual training to the humanities.

The demands for ualue are no exception. Before VE can generate the return it is capable of generating, the basic interrelated philosophy behind the terms value and function must he thoroughly inculcated throughout the organization attempting to recap the return of which VE is capable of generating. This means training--top to bottom training by the best available means by the best available talent. VE can be well worth it! Why? This discipline (and the term is knowingly used for emphasis) offers what has been called "industry's biggest contribution to the economics of business". This is true, because VE offers industry a means of coping with two of its biggest problems, costs and communications—provided the VE training is comprehensive and effective.

Having decided to "go" with a VE program, management then faces the decision on how to educate and train. Obviously, two approaches are'open: through in-house talent, or by way of outside professional help. Quite naturally, the smaller firm will tend toward the inside, do-it-yourself approach, because this approach appears to he less expensive. But in the long run, the retaining of VE consulting services often turns out to be the most economical approach to training, no matter what the size of the firm may be.

In making the mode-of-training decision, keep in mind several points: VE is **a** potent, and potentially explosive technique, which, in the hands of the neophyte, could have disastrous and disruptive organizational effects. At least a philosophy of the technique must be communicated *to* executive and worker alike, presenting a severe acceptance problem for inside value personnel; and, the exclusive use of inside talent will require more monitoring time on the part of management to assure a smooth development of the VE program, all of which could more than offset the costs of outside professional help. Therefore, the evidence all points to the use of "pros". The professional value engineer is just one more type of management consultant—probably one of the most effective invented to date. The decision makers of an organization would not consider the use of do-it-yourself help on a management problem; they would retain expert, qualified management consultants--if they want to improve their profit picture. The same goes for the experienced and qualified consultant in VE. The consultant won't be difficult to select; in a relatively short time he'll be able to show you what to expect, and he'll be able to prove it. His service will go far beyond training alone. He'll he able to offer advice, counsel, set up the program and keep it going. He will undoubtedly he worth his salt–and more.

Whether or not professional consulting services are utilized to train personnel and get a value program started, the objective is to develop an in-house training capability. Outside sources are available for guidance, including the Society of American Value Engineers (S.A.V.E.) and several universities and colleges that offer Value Engineering Courses, among them, UCLA, Northeastern University, and Boston College. If a Department of Defense Contract is involved, the cognizant Value Engineering Program Manager will provide information on sources for training and guidance.

4-2.3 TRAINING PROGRAMS

The techniques employed, and the type of training will vary with the organizational level of the personnel to he trained. An overall program must be set up for: top management, operational management, operating personnel, and value engineers.

4-2.3.1 ToP Management Briefings

In these sessions, which can he relatively short, management must be made aware of:

1. What to expect
2. What to demand

3. The benefits
4. The importance of value objectives.

To communicate this awareness to top level decisionmakers, it is obvious that the "show" must be carefully planned and staged, and therefore should be presented by top level professionals. At the completion of these sessions, this all-important audience must take from the "show" absolute conviction that VE will work in their organization.

To generate this conviction, the "message" of the orientation will, of course vary with the type of business and the size of the organization. But one point in particular can provide the clincher. If possible, prior to the first session, pilot or preliminary VE studies should be made, demonstrating, first hand, the kind of VE results that appear to be feasible using the company's own products, services, or processes. Leading up to this "closing act", this elite audience should be oriented in:

1. Value—a concept both desirable and attainable
2. The methodology of VE
3. The Value Program—its organization and operation
4. Program cost criteria
5. Contractual aspects
6. VE pilot studies
7. Question and answer period.

The leader or speaker at these decision-maker orientation sessions, must be particularly careful to watch for "feed back" on his effectiveness in communicating to this sophisticated audience. The question and answer period will provide this feedback; watch for the number as well as the quality of the questions asked, If the audience is slow to respond with questions, strive to give them a better "show" the next time.

4-2.3.2 Operational Management Orientation

The objective here is **truly** to ***orient,*** which is defined as, "to adjust with relation to, or bring into due relation to, surroundings, circumstances, facts—or to familiarize with new surroundings, circumstances, etc". This orientation can be accomplished through a series of well-planned lectures of approximately one hour each. The content of the lectures should be such as to "familiarize" this level of management with the "circumstances" that will arise as a result of the VE program. If possible, it is very effective to have the lectures presented by "one of their own"—a member of operational management who has been through a V.E. workshop seminar and is sold on the concept.

Experience has shown that the enthusiasm for the VE concept just begins to erode at this level-and such a reaction is understandable. This level of management is already usually overloaded, and is truly "the man in the middle"; he gets kicked from both sides—or rather from top and bottom. For this reason, he is most likely to say "What's in it for me?" to any new concept. This is a good question—a question that will challenge the ingenuity of the indoctrination leader. The leader must be prepared to field the question with answers that are appropriate and feasible in the specific organization. Remember "change" is a particularly dirty word to this man; it means only one thing to him: more work.

Therefore, the presentation to this audience should be such as to allay fears and misapprehensions— to anticipate the "roadblocks". To do so, the leader must be able to forecast what the application of VE will eventually do for the "middle man"—not add to his work, but reduce and smooth out his load, give him help.

A suggested lecture series for operational management should include such topics as:

1. Value:
   a. Aconcept
   b. A definition
   c. A management tool
2. VE History:
   a. How it began
   b. By a member of operational management
   c. What it has done
3. VE Methodology:
   a. The functional approach
   b. Not "just another" cost reduction program
   c. What it can do for "us"
   d. What it has revealed in "our" products
   e. Opportunity for creativity to express ideas
   f. The human relations problem
4. What Do You Think?
   a. Question and answer period
   b. Air doubts, apprehensions
   c. Sell concept.

42.3.3 Operating Personnel Indoctrination

The objective here is to get the VE "word" disseminated throughout the organization. There are several media that can be employed to do this. Initially, practically all operating personnel should be exposed to the VE philosophy through a series of lectures, followed by the use of any media that constantly keeps the VE idea before these personnel. The use of posters, articles in the company newspaper, notices of VE awards, and particularly wide-spread publicity on company VE policy—all convince this audience that the company is really serious about the program. Mere publicity is not enough. This audience is always inclined to ask, "What is in it for me?". The statements about greater job security, a more prosperous company, overcoming competition, and all the usual cliches will not do much to motivate this audience toward making its contribution to the VE program. Remember, case histories show that operating personnel *have* made valuable contributions to VE when they have been cleverly indoctrinated and have been offered worthwhile incentives. Don't forget, industrial psychologists tell us that the "feeling of belonging", or "being a part", and making a contribution, is one of the employee's greatest desiressometimes more than money. Build on the desire!

Therefore some suggested points for conveyance to this audience are:

1. Introduction:
   a. Everybody ought to be interested in VE!
   b. As wage-eamers, the application of VE is helping American industry maintain its economic position in world markets, thereby protecting our jobs and our careers.
   c. As taxpayers, the Department of Defense (DOD) VE program has come to the defense of the defense dollar, with audited savings to us, the taxpayers, of over $1.1 billion for fiscal years of 1963 through 1966.
   d. As consumers, we today purchase many products at not only lower prices, but with greater value as well, because the manufacturer of those products is applying VE as an effective management tool.
2. Value:
   a. We search for it every time we go shopping
   b. There are several kinds
   c. Putting it to work for **"us"**
3. How It *All* Began:
   a. Where
   b. By whom
   c. What it meant
   d. Itsgrowth
4. Value-Function:
   a. The twin keys
   b. A workable concept
5. Case Histories:
   a. Other companies
   b. Our company
6. ***Our*** *Company's* VE Program:
   a. Policy
   b. Goals
   c. We need your help
   d. What it can mean to ***you***
7. Question and Answer Period.

42.3.4 Value Personnel Workshop Seminar

This is the professional level for the actual execution of value programs. Therefore, for this audience we need more than briefings, indoctrination, or orientation; the need here is education—intensive, "dirty hands" work with the actual development of value projects drawn from company files. In this training lies the proof that VE ***will*** work for the company that the value professional represents. Workshop programs for this training range from approximately 40 to 80 hours, and even 80 hours is not too much. Members of management who are responsible for the selection of personnel to take this training should never lose sight **of** the objective: these personnel are being educated in a discipline and a methodology that could revolutionize the whole business. In view of this potential and the possibility of at least a 10:1 return, the best available training is none too good.

Therefore, it is highly recommended that value personnel be trained only by professionals, by those practitioners who have, themselves, dramatically demonstrated the efficacy **of** VE for other organizations. At first consideration,

the cost may seem high. But bear in mind that a potent management tool is being developed, and the gains are usually commensurate with the fees charged by any recognized management consultant.

The curriculum for professional value engineering training varies with the person or firm doing the training. However, any comprehensive training program will essentially take the student through and provide practical experience in all six phases or steps of the VE methodology as covered in par. 4-4.2. Therefore, no attempt will be made here to outline such a course. But if the consultants offering the training are truly professionals, they will not hesitate to state what can be expected, or demanded, from their trainees, once the course has been completed. However, it is further recommended tliat follow-up counsel by the professional, to check on results and policy, can be a great bargain.

4-3 THE IMPLICATIONS FOR THE VALUE ENGINEER

As a professional value engineer, your career will consist of a never-ending series of implications—and complications. But then, that is what you are being paid to handle, and the level of compensation is very likely to be (or should be) commensurate with your efficacy in handling these complications. Introspection, particularly when flavored with paternalism, is probably out of place in a technical text. But the reader will possibly tolerate an observation: in looking back over 30 years experience as an engineer, designer, and writer, ,VE appears to present the ingredients for an unusually attractive opportunity. Also the opportunity is unique; it is not for young men only. The mature man, backed by the experience necessary to command respect, can use VE as the vehicle to satisfy his desire for a more creative outlet—and as the manager of a VE team, attain "consulting" status. To the young man, VE opens the door for a chance to cope with two of the most perplexing problems facing business and industry: costs and communication. Contributions to the handling of these problems have got to bring rewards and recognition.

Since 1958, when the first edition of this handbook was being written, the author has had the privilege of lecturing on the importance of communications at many VE seminars. During those twelve years, it has therefore been a further privilege to associate with some of the practitioners who have helped to build value engineering into a profession.

Because of this background, there is an acute awareness of the cost/communication integration occurring in VE. Emphasis (as it should be) is on the former, but the importance of the latter is getting increasing recognition. Why? Because the reduced-cost story of VE cannot be sold without effective communications. So ... welcome, Mr. Technical Communicator ... and welcome, Mr. Salesman, to the world of VE! As a practicing value engineer, you will be called upon to play many roles. But the VE verb-noun methodology, when used to analyze your own profession, will always reveal the basic functions: produce communications; sell ideas.

Ask yourself the question: "As a value engineer, what is my true task—be an engineer ... a creator ... a diplomat ... an oracle?" Yes, you will be expected to play all these roles, and more. But every worthwhile activity produces a product of some kind. What will your VE product he? A report, of course! If you didn't come up with this answer, engrave it indelibly into your consciousness now. You can be brilliant, creative, handle people, reduce costs, improve products—endlessly, but unless you can sell your ideas through live, on-your-feet presentations, and through effective written communications, forget it!

Through many years of writing, editing, and the teaching of technical communications to scientists and engineers, the author knows whereof he speaks. And he further therefore knows how desperately industry and business is looking for—and rewarding, skills in communication. Thus the coverage in this VE book on communications (Chapter 5j. Also, thus the admonishment: study well the techniques in this Chapter. The necessarily limited coverage here only scratches the surface of the discipline. But the practice of even these fundamental techniques should help you become not just a writer, but a communicator. Millions of words are written every day; tragically, few of them communicate. Get out of the herd! But be prepared. Always remember, as you pull yourself up by the generation and

communication (selling) of ideas, you will meet resistance. In fact, the level of resistance will be in direct proportion to the amount of change your ideas engender. In meeting the resistance, adopt a conciliatory attitude; never lose sight of the fact that as a practicing value engineer you are dependent upon others for information. Being a diplomat has its rewards.

One of the best ways to meet the resistance and gain acceptance is through seruice. A very successful young value engineer once told the author:

"I first started in VE in a very small company. The resistance to my ideas and recommendations seemed insurmountable. I was desperate. Then one day, the chief design engineer asked me if I could get a particular piece of information for him. I did—immediately. From then on, I was approached more and more to ferret out answers to technical questions on materials, methods, and the general economic approach to things.

"This experience pointed a direction. I made every effort to build up my store of data by doing literature search, by participating in professional societies, and by attendance at conventions. I developed the reputation for being an oracle. As my reputation grew for coming up with answers, the resistance to my VE ideas (and changes!) diminished.

"But I consider another point in human relations even more important: I watch the use of the first person singular; I avoid the use of it, particularly in the area of taking credit. And you know what? ... the recognition of my work has accelerated as a result of this attitude!"

Want to join the club? Be of service, Mr. Value Engineer!

4-4 THE VE METHODOLOGY

A product, component, item, service, or process is value engineered through a systematic and organized study which follows what has been proved to be a successful methodology. The study is usually performed by a VE Study Team composed of VE trained individuals from company activities and departments responsible for the design, manufacture, sources of supply, and sale of the product under study. The activities of the Study Team in performing the study are determined by the VE Job Plan. The Job Plan consists of six phases, each represented by a set of Work Sheets. In developing the skills to practice the methodology, it is imperative that the Job Plan be followed—meticulously. Therefore, a Leader should be appointed from the Study Team, to assure that the study progresses in accordance with the Job Plan and that detailed steps of the study are accurately recorded on the Work Sheets.

4-4.1 SELECTION OF PROJECTS

The formal VE methodology includes six phases. It ought to include seven. Before the methodology can be applied, there must be a product, service, or process to which it can be applied. A standardized approach to the selection of VE study projects has not evolved, because there must be too much variation in the approach in accordance with the company, its policies; its products, its size, etc. Therefore, only general criteria for selection can be given. The existence of this situation is unfortunate, most of all, for the neophyte value engineer. His ingenuity may be taxed to the utmost—even before he really gets started. He will be called upon to exhibit an uncommon amount of common sense.

In the selection of projects, there are three general areas to watch-and probably in the following order of importance:

1. Yourself
2. The item itself
3. The item in the market place.

In watching YOURSELF—watch your step in the selection of study projects:

1.	DO...	Striue for a sixth sense in smelling out successful items (The sense will come with experience!)
2.	DO...	Check availability of data (If the information isn't there, don't start.)
3.	DO..,	Go for a good mix of long-range vs short-range projects (Get yourself some good early bread-and-butter items. Hold the big technological break-through projects until later.)
4.	DO...	Match the project to your background and skill. (For

example, if your skill is in electronics, pick your starter projects in this area.)

5. DO... Estimate the potential savings—arly. (You've got to know where you are headed.)

6. DO... Equate your resources to your project. (If for example, you have a $100,000 budget, don't "shoot" it on a project estimated to take $90,000.)

7. DO... Determine scheduling factors and estimate the time required to complete the study. (There is no sense in starting if you can't finish in time.)

8. DON'T. Choose cost-troublesome items just because they are troublesome. (Look at the value potential; it may be so low that your chances for retum are also very low.)

9. DON'T. Select "sacred cow" projects. (Every firm has such items, and to turn the spotlight on them kills management support right from the start.)

10. DON'T ... Pick items that appear to require high implementation costs. (These costs could negate savings.)

In scrutinizing the ITEM, the answers to the following questions are likely to uncover items that have good potential for value improvement:

1. *How* old is it? If the item has gone unchanged for a long while, chances are it is ready for updating.

2. What is the complexity? "Busy" items are always good candidates for simplification and cost reduction through VE.

3. Are there procurement problems? If purchased parts are not being delivered on time, or quality varies, or sole source supply is evident, take a look. The item may have bugs that VE could eliminate.

4. *How* about cost? Where the level of costs is suspect, the item represents a high-priority qualifier.

5. What about materials? Are they unusual, exotic? What about waste? Is it evident? Could it be reduced?

6. Are complex equipment and tooling required? From the standpoint of the VE functional approach, many such parts have been easy to simplify.

7. Has the part been ouerdesigned? Look for tight tolerances, fine finishes, excessive machining operations, and unnecessary functions.

8. *Is* volume or usage high? Penny savings (or even mills) on these items add up to volume annual savings.

9. What are the support costs? Are they high? If so, VE could possibly increase reliability and reduce maintenance expense.

10. *Is* it an interchangeable item? On guard here! To wade into such an item without a thorough survey of the consequences of change could be disastrous.

In surveying the PERFORMANCE OF THE ITEM in the market place, watch for:

1. High profit margins. The tendency is to select low-profit items to get them out of trouble. However, this may not be the smartest approach for the value engineer; maximum savings can be realized on components that show a higher profit margin, and can therefore be value engineered to show a higher percentage of saving;. Such a tactic may permit the VE to "carry" the low-profit components until he can get at them.

2. Competitiue position. How is the product fairing in the market place? Is it being pushed competitively—because of cost? ... reliability? ... aesthetic qualities? A value engineering review could possibly bring about a better balance between primary, secondary, or tertiary functions.

3. Customer reactions. When the "complaint department" is overworked on a particular component, product or item, a VE study is overdue. This is usually an A-1 priority variety for VE study.

4. Future potential. Where has the product been in sales and where is it going? If it is on the downswing, can VE restore it—or is the timing too late? If volume of sales is low now, but headed up, will it go high enough (other factors considered) to warrant a VE study now against future savings!?

5. Comparative analysis. It is only a "ball park" technique, but rough as it is, application will sometimes put the value of an item in better perspective. Check the unit cost of an item per pound ... per inch ... per gallon ... etc. This cost/unit comparison provides a quick check-out for value—the value of your products, or the value of purchased products.

4-4.2 SETTING UP THE VE STUDY

The complete **VE** study is composed of *six* phases or steps, as follows:

1. Information Phase
2. Functional Analysis Phase
3. Speculation Phase
4. Evaluation Phase
5. Presentation and Program Planning Phase
6. Implementation Phase.

There are Work Sheets for each phase. These sheets serve two functions: they provide a step-by-step guide to the study, and they also provide a means for recording the information developed during the study. Typical forms for each of the phases are shown under the topic headings that follow. Prior to the start of the study, copies of these forms must be reproduced and on hand for use of the Study Team. Also a Title Page sheet, similar to the typical sheet illustrated in Fig. 4-2, should be prepared and used on the documentation for every study.

All Study Team members should be constantly alert to the fact that they have a two-fold mission:

1. To perform the study
2. To report the results of the study.

In reality, the second step of the mission is more important than the first. What good is all the hard work that goes into the study, unless the results can be communicated to management, approved, and implemented?

To aid in the preparation of the presentation and the report, most of the Work Sheets include an area at the bottom for entering Report Notes. It is here that the salient points for each of the phases should be logged. By doing so, you will essentially be preparing a report outline **as** you go. Then, when you are ready to write the report, or the copy for the presentation, it will be much easier because you have kept your mind in gear in terms of writing. Further, you have avoided one of the cardinal sins of the part-time writer: *not **starting*** early enough (see Chapter **5).**

Before the study can actually be started, a Data Package on the product, service, or process must be assembled. For a product or manufactured device, the package should include:

1. Detail and Assembly Drawings, Layouts, or Sketches
2. Specifications and Performance Requirements
3. Operation Sheets or Manufacturing Plan
4. Cost Data on:
   a. Purchased Material
   b. Fabrication
   c. Assembly
   d. Processing
   e. Overhead
   f. Parts
   g. Hardware
   h. Components
   i. Assemblies
5. A Model, Assembly, or Parts
6. Production Quantity Forecast

If the subject of the study is on a service or process, **as** much information as possible should be assembled on the activity. The data package for an activity should contain:

1. Chart or description of organizational responsibilities
2. Information **flow** chart
3. Sequence of events
4. Flow time
5. Frequency of activity
6. Equipment capability and utilization
7. Present capital investment
8. Material and supply costs
9. Maintenance cost
10. Recurring labor costs and overhead

4-4.2.1 Information Phase

After the Data Package has been assembled, you are ready to go to work. Your first step is to educate yourself on the project under study—to have a complete understanding of it by being able to comprehensively answer the following key questions:

1. What is it?
2. What does it do?
3. What does it cost?

(Typical)

VE Study No. _____

SUBJECT: _____

_____

_____

PART OR I.D. NO. _____

STUDY TEAM: _____ LEADER

_____

_____

_____

_____

_____

_____

_____

COMPLETION DATE: _____

CHARGE NUMBER: _____

Figure 4-2. ***Title Page***

A lot of preliminary questions will have to he answered on the way to answering the "key" questions. Jot them down. You'll appear to be a lot more organized when you see somebody to get answers to your questions.

It will pay you to he thorough at this point in your edification. if you aren't, you will experience difficulty in analyzing functions in the next phase, and will have to hack-track and learn more about the project.

Look at Work Sheet No. 1 (Fig. 4-3). The information required for Items 1 through 4 is rather obvious. The space allotted for each of these points of information is small, but this should he enough space if your descriptions are succinctly cast. If they are, you can be reasonably sure you, as well as others, will understand the descriptions. Opposite Item 5, enter the names of the operational areas where problems on the project are known to exist, such as manufacturing, quality control, delivery, etc. Item 6 refers to those economic factors that will he required *to* make an analysis of alternatives later in the study. An explanation of the information to he entered follows:

(a) The base number of units produced per year for purposes of the VE study
(h) Estimated useful life of the units
(c) If the product under study is in the pre-release design stage, the delivery date of the first unit. If the item is in production, enter the first effective date at which major changes will be considered
(d) This entry refers to the period required to absorb the cost of implementing the VE proposal.
(e) This cost represents the amount agreed upon for comparing the cost of altematives developed during the VE study.
(f) Dollar amount should he entered here for each of the principal work centers involved in producing the item under study.

Log the names of all liaison personnel under Item 7. Even though they are in the "directory" and you know them, put them down. Remember, you are putting together a complete VE study package for now—or for the record five years from now. Don't forget the Report Notes entries. Document those unique features or happenings of this part of the study—information that you may not he able to readily recall when you write the report which may not be started until much later.

4-4.2.2 Functional Analysis Phase

This is it. To borrow an expression from the younger generation, we are "Down to the nitty-gritty!"

To this point in this book we have related: the basic philosophy of value engineering ... its advantages ... why everyone ought to he interested ... and why management should he interested. You might say we have been building to a climax to make a point.

Now let us set the stage for the climax. Assume that: (1) management has been sold; (2) VE policy has been established; (3) value personnel have been trained; (4) a VE Study Team has been formed; and (5) the team is into the initial phases of the Study, i.e., a Data Package has been assembled, and the Work Sheets for Phase No. 1, "Information Phase" have been completed. Of course, it is likely (and this is as it should he) that there was contention among the Team members in arriving at agreements on the syntax and semantics for even the "Purpose and Use", and "Operation and Performance" statements of Work Sheet No. 1. But by judicious patience and guidance, somehow, Mr. VE Team Leader, you got them through the answers to the first question, What *Is It?*, of the overall VE philosophy. But what you've come through is only the prologue to what will follow!

Now you must come face to face with the key questions of the Functional Analysis Phase: "What Does It Do?" and "What is that worth?" To come up with comprehensive answers to these two questions, it will he necessary to:

1. Identify function
2. Determine worth
3. Know your costs.

Having identified the functions, we are now going to make a relative appraisal of those functions. The whole objective of this appraisal is to arrive at a figure representing *Value* Improvement Potential (VIP) for each of the functions identified. To get the VIP involves various techniques for estimating the worth of

(Typical)

VE Study No. _____

INFORMATION PHASE

1. PURPOSE AND USE _____

2. OPERATION AND PERFORMANCE _____

3. PHYSICAL AND ENVIRONMENTAL REQUIREMENTS _____

4. SUPPORT AND TEST REQUIREMENTS _____

REPORT NOTES

Figure 4-3. Work Sheet No. 1

(Typical)

VE Study No. _____

INFORMATION PHASE (Cont'd)

5. Known Problem Areas _____

_____

_____

6. ECONOMIC FACTORS:

(a) Number of Units Per year _____ (b) Useful Life _____ years

(c) Unit No. 1, Effective Delivery Date _____ (d) Amort. Period _____

(e) Present Manufacturing Cost $ _____

(f) Labor Rates	Overhead	G&A Profit
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. LIAISON PERSONNEL:

(a) Engineering _____ Ext. _____ , _____ Ext. _____

(b) Purchasing _____ Ext. _____ , _____ Ext. _____

(c) Mfg. Eng. _____ Ext. _____ , _____ Ext. _____

(d) Estimating _____ Ext. _____ , _____ Ext. _____

(e) Other _____ Ext. _____ , _____ Ext. _____

REPORT NOTES

_____

_____

_____

Figure 4-3. *Work* ***Sheet No. 1*** *(cont'd)*

the function, as well as an analysis of actual cost of the function. With *worth* and *cost* data available on each of the functions, it is then possible to determine which of the functions offers the best potential for value improvement—and thereby provide a sense of direction for the best application of the available VE resources throughout the remainder of the study.

Now comes the moment of truth. To identify function seems like getting a simple answer to a simple question, *"What does it do?"*. In fact, on the surface, it seems so simple that only a "simple" mind would be required to answer the question. In a sense this is true; a mind that works *in a simple way* is required—a mind with the ability to reduce concepts, ideas, and analyses to their lowest common denominators. Why should these mental gymnastics of reducing things to truly descriptive basic concepts be so difficult? Perhaps it is because we *assume* we really know, when we don't. Also when attemptirg to communicate basic concepts to others, there is always the inclination to assume more knowledge on the part of the receiver than he really has. We expect *him* to reduce the concept to basics.

Again, why all this emphasis on a basic functional answer to the question, *"What Does It Do?"* Because the functional approach is the very heart of VE. This approach is not directed at *how to make the part for less,* but rather at *how to achieve the essential function for less.*

4-4.2.2.1 Watch Those Aliases

Have you ever noticed how misleading names can be? Take a careful look at the two questions: "What is it?" and "What does it do?" Notice that, in attempting to name an item and answer the question, "What is it?" there is a tendency, particularly in the names of technical items, to also answer the second question "What does it do?" In christening an item, as well as describing its function, the answers to these two questions often become interrelated—and erroneously. If we accept someone else's name for an item, we are very likely to be mislead.

Take an every day item such as a pencil, for example. The dictionary defines "pencil" as "A slender tube of wood, metal, plastic, etc., containing a core or stip of graphite, a solid coloring material, or the like, used for writing or drawing." That is a pretty good definition for everyday use. Ask nearly anyone "What is a pencil for?", and you will get the answer, "To write,: of course." Now ask a value engineer the same question, and if he has really mastered the functional analysis approach and technique, he will give you the answer, "To make marks, of course." So the value engineer, through the discipline of the functional analysis approach, is ever on the altert to get things down to basics. He is always ready to ask himself, "What's in a name?"

The value engineer is particularly alert to the names of things, because there is probably no area where parts, components, or items, are so likely to be misnamed, as on design drawings or in parts lists. For example, a drawing titled "Microwave Shield" was reviewed in a recent VE study. The object appeared to be just a chassis cover. So the value engineer began to ask himself what the *true* purpose might be. If the cover was to serve as a shield, was it to shield the enclosed circuit from external microwave radiation, or was it rather, to shield other circuits from radiation generated by the equipment within the cover? Investigation by the value engineer revealed that this part was only a dust cover; to describe this function, the value engineer used only two words, a noun and a verb, "repel matter". If the value engineer had accepted the title on the drawing under study, he would have described the function as "repel radiation". It is quite evident that the cost of a cover to repel radiation could far exceed the cost of a cover required only to repel matter, or dust. Therefore, what's in a name? To the value engineer a great deal is in a name; when the name of a part does not properly identify its function or use, this alias may lead to unnecessary costs.

4-4.2.2.2 The Critical Step

The functional analysis phase is perhaps the most critical step in a value engineering study. We have seen how the misnaming of a part, or rather the failure to properly define the function, can lead to unnecessary costs. But there are other factors that point up the importance of the functional analysis phase, and how critical it can be in establishing the proper direction for the complete VE study. We can

only repeat: it is this emphasis on the analysis and the subsequent evaluation of required function, that makes the VE approach radically different from any other cost reduction efforts.

This difference was glaringly evident in another VE study. The part under study was a glass reinforced plastic box, fabricated to be used as a cable housing on an emergency release mechanism. Prior to the VE study, the cost of this housing had been reduced by 50% by improving the method of manufacture. This cost reduction resulted from asking the question, "How can it be made for less?" When this housing became the subject of the value engineering study, its function was identified as "contain cable". The study then concentrated on developing and investigating alternate methods of achieving the function, "contain cable". The VE proposal, which involved a modification of an existing, injection molded polyethylene cap plug, produced a 95% reduction in cost over the cost that had been attained by attempting to merely make the part for less. By putting the emphasis of the study on function, the door was opened to a wider variety of possible alternatives that would do the required job.

Thus the functional analysis approach has been shown to be a very critical step for at least two reasons: avoidance of unnecessary costs, and a greater choice of "a better way".

4-4.2.2.3 The Verb-noun Technique

Perhaps you noted in the two value engineering studies just given, the use of pairs of words to describe function. For the chassis cover it was "repel matter", and for the cable housing it was "contain cable". If you hadn't, please note that these two words always represent two parts of speech, a verb followed by a noun. This verb-noun technique, for the identification of a function, provides a sure means for boiling the description of the function down to its lowest common denominator. The function is not properly described until that function can be expressed by that combination of the proper verb and noun, which most accurately identifies the characteristics necessary for the device to work and fulfill a need.

To make the point, let us retum to the pencil. As stated earlier, the value engineer would identify the function of the pencil as to "make marks". Why? Because that is the one thing that the pencil must do in all of its many applications, For example, the author uses a pencil to write words; the mathematician uses a pencil to perform calculations; the artist uses a pencil to draw figures. But in all cases, basically, they are all "making marks".

The value engineer insists on identifying function with the verb-noun technique because he knows that this will get him down to the basic function. Let us go back to the pencil again, Most pencils include an eraser, resulting in a combination of two functions which are related in application. Now the pencil "makes marks" and "obliterates marks". A mechanical pencil adds the function of "moves lead". It may also have other added features such as a clip, a gold finish—and could also include a cigarette lighter or a flashlight. Combinations of functions and features add different kinds of value for the pencil, and therefore also add cost.

To drive the point home further, consider an item such as a tape recorder. If the function of the device has been described as to "record sound pulses'" we imply one level of cost. When we expand the function to "record musical sound pulses" or to "record live symphonic sound pulses" or to "record light pulses", we get an ever-ascending scale of costs. Thus it should be noted that function and cost are interrelated. The only way we can safely segregate these functions in cost areas, is by use of the verb-noun technique.

It should be evident, therefore, that one of the most helpful things the value engineer should do in applying the the technique, is to make up verb-noun tables particularly applicable to the types of products or projects on which he will be performing studies. Note that one type of table could be prepared for electronic components, and another for mechanical projects, and still others for application in the fields of hydraulics or aerodynamic parts, for example. Note also that the verbs are likely to break down into two general categories describing work functions and sell functions, which in turn, are likely to be in line with the various types of value expressed by the product. The noun tables in turn, are likely to break down into those words which describe measurable and nonmeasurable features. Having such tables on hand during subsequent VE studies will greatly help to trigger the thinking

process in the functional analysis phase.

Another important part of the functional analysis phase is the classification of the function. In a comprehensive VE study, each feature or part must be analyzed to identify those functions which are necessary, and to determine if the current cost is in line with the relative value the function contributes to achieve the objective of the item being studied. Classifying the function involves determining whether or not the function is basic or secondary. Basic functions are those which are absolutely essential if the product is to work and perform its intended objective. Secondary functions, on the other hand are those which are essentially related to esteem, appearance, or convenience, and which may be necessary to help sell the product. Without this careful classification of function, it will not be possible for the value engineer to determine the relative value of these features or functions and, therefore, to determine if the cost of the overall item represents true value.

4-4.2.2.4 The Discipline of the Functional Approach

In summary, it should be noted that the functional approach is coercing the value engineer into following a prescribed methodology. If he deviates or is not meticulously thorough, the succeeding portions of his **VE** study cannot produce the anticipated results. Through the functional approach he will be disciplined into realizing that most things cost too much, and he will see how to identify the specific areas of unnecessary cost and how to set up cost targets to eliminate or reduce those costs. The value engineer will also realize that his discipline is forcing him into a different way of thinking about problems and how to clarify a problem. But most important of all, he will become function oriented rather than hardware oriented,—the kind of orientation that removes all unnecessary costs without any possible sacrifice of reliability or degradation of quality.

4-4.2.2.5 Techniques for Determining the Worth of a Function

Take another look at this heading. We are now going to consider techniques for getting at worth—but the worth of performing *a function*, not the worth of parts, items, or hardware. It is important to grasp this concept; it is one of the concepts of the **VE** philosophy that sets **VE** apart from other cost-reduction techniques. Having identified function, we are going to work with function—exclusively. Forget about hardware! For example, what would you say is the value (worth) of a wing hinge pin for a multi-million dollar aircraft? The pin costs $20.00 and performs the function "holds wing". Does $20.00 represent good value for a part performing such a critical function — function on which the whole investment and operational reliability of the aircraft may depend, to say nothing of the safety of the crew? In spite of the critical importance of this pin, is there any reason to believe that an equally reliable pin for performing the function could not be produced for less? Of course not!

The point is this: in establishing the worth of a function, we are not concerned with the possible uses or possible failure of the end item; we are no longer concerned with the device (as a piece of hardware), but only with the function which must be provided. Therefore, the principle by which we establish worth, takes us right back to our basic definition of value:

> The lowest price we must pay to reliably accomplish a giuen function.

The phrase we *must* pay sets the whole theme for worth, and indicates that worth is a relative quantity, and estimates of worth are dependent upon such factors as:

1. The state of the art
2. The thoroughness of the **VE** study
3. The accuracy of the available information.

In the application of the techniques for estimating worth, we must keep these factors solidly in mind.

4-4.2.2.5.1 Worth by Judgment and Experience

You will recall what was said earlier about one of the many qualities the value engineer is expected to express: "an uncommon amount of common sense". This rare intellectual ability represents the basic technique for determining the worth of a function.

You will drive your thinking into common sense channels if you will consider that it is your money being spent to achieve a function. Would you be willing to pay $520 to contain 200 gallons of fuel ... or $16 to house a small length of cable ... or $5.25 for a fuse? Chances are you wouldn't. (Therefore, keep these examples of function and their worth in mind; they will be reviewed in succeeding techniques for determining worth.)

You use judgment and experience every time you go shopping. You wouldn't pay 30 cents for a 10-ounce can of beans, if right next to the 30-cent can there happened to be a 12-ounce can for the same price and for the same quality of beans. Use the same kind of economic yard-stick in putting a dollar value on the *worth of* a function—your dollars!

4-4.2.2.5.2 Worth by Comparison

This technique involves a mental search for the most simple, least costly device that could possibly fulfill the required functions. This approach resulted in a successful VE study, cited earlier, where the function had been identified as "contain cable" for an emergency release mechanism. The "comparison" technique revealed an existing cap plug, which, when modified slightly would perform the function "contain cable" quite well—and with a reduction in cost of 95%.

Another example of the application of the "comparison" technique, involved a VE study investigating a 200-gallon fuel tank costing $520. This special tank was compared with four standard 50-gallon, steel drums, the total cost of which was $25. The Study Team then estimated that this $25 price would be doubled to adapt the drums to the conditions under which the present tank was used. Therefore, $50 was set as the worth of the function, providing a base for the development of possible alternatives for further investigation.

4-4.2.2.5.3 Worth by "Blast and Refine"

This technique pursues a concept to "blast" away all the features of the design of an item so that the essential function of the item can possibly be related to the most simple item that could perform the function. Then, by relating the cost of the simple object to the cost of the design, it is possible to determine whether or not there is room for value improvement. . By following this procedure, it is possible to develop a "target" for value improvement: After blasting, refine to attain the optimum compromise of essential function and necessary features. Add the required features to the simple object selected, and attempt to evaluate each feature in terms of dollars.

This technique can be pursued further to develop possible alternatives and come up with a further refinement of the worth of a function. Consider the classic example of the circuit breaker. It had a rating of 20 amperes at 220 volts and was being manufactured at a cost of $5.25 to perform the function "break circuit". The initial "blasting" concept suggested the use of an ordinary household circuit breaker. However, such a unit, although it has a 20-ampere current rating, has only a 110-volt, electrical potential rating. But, it was being produced for $0.53. Why not consider, for the purposes of establishing worth, the possibility of two of these 53-cent breakers electrically connected and mounted on a common base. To do so, these costs were estimated as: base, $0.50; circuitry $0.30; interconnecting bar, $0.20, giving a total of $2.06 to possibly perform an equivalent function, "break circuit".

It is interesting to note what happened when the "blast and refine" technique was applied to the household type of circuit breaker. Investigation revealed that such devices operate on the basic principles of:

1. The physical detachment of two elements of a circuit at a given current level
2. The ability to reset the detachment.

Therefore the action of the device represented the basic function to be performed. By "blasting" the concept, the investigators arrived at the simplest device to possibly provide the *action*—a mouse trap costing four cents. Then, by "refining" to add the necessary features, the estimated value (worth) of the function was put at 39 cents. It is a matter of record that this analysis led to the development of a circuit breaker, based on the mouse trap principle, for a manufactured cost of 30 cents!

4-4.2.2.5.4 Worth by Comparison With Existing Standards

The knowlege of the existence of available "standard" parts or items can be extremely

helpful to the value engineer in establishing worth and producing value. Many times designers have "redesigned the wheel"—duplicated the efforts of other designers—when, in effect, the part to be designed already exists. Or, through what are relatively simple modifications, the "standard" part can be changed to fulfill the necessary function at greatly reduced costs, when compared tu the cost of designing a "new" part.

This technique depends upon the value engineer's ability to recognize the similarity in function between the standard part and the part under study. Repeatedly, experience has shown that this ability, combined with knowing where and how to look into "standards", can greatly enhance the value engineer's effectiveness in not only establishing the worth of a function but in arriving at alternate solutions.

44.2.2.5.5 Worth by Value Factors

This technique establishes an arbitrary scale, say, from 1 to 10. The item under study is assigned a number on the scale, say at 5, which becomes a base for value comparison. As the Study Team, through various techniques of investigation, develops alternatives, the team estimates the relative positions of these alternative ideas on the arbitrary value scale, as compared to the design of the original device. Ideas which are judged to fall below the base figure of 5, are candidates for further development.

4-4.2.2.5.6 Worth by the Establishment of Cost Targets

As the value engineer gains experience in the analysis of function, he will begin to develop a "sixth sense", permitting the establishment of cost reduction targets. This technique is particularly effective when working in nonproduct areas. The most effective approach in setting a target is to determine what return on the cost of the study is required to make the effort profitable. This target provides stimulation and motivation for the value Study Team, and helps to prevent bogging down.

The stimulating effect of a cost reduction target, was forcibly demonstrated in a value engineering study of a transistorized audio amplifier. A target of a 30% cost reduction had been set for the team of four people, who had been assigned to complete the task in two weeks. The team, by the end of the first week, had only 15% out of the product, and wanted to quit. The value manager, upon reviewing the work of the team, pointed out that they had limited their investigation to the design features of the amplifier, without looking into the production operations involving manufacturing, inspection, and test. By the end of the second week, the study team had developed proposals for removing 33% of excess costs from the amplifier.

Targets do help. Without them, this team would probably have settled for 15%.

4-4.2.2.5.7 Worth by Value Standards

The end-item value of a device represents the sum of the value of the various functional features of the device. However, the relative contribution that a feature makes to the end-item value, is not necessarily proportional to the cost of that feature. This limitation is especially evident in determining worth by the more empirical techniques such as judgment and experience, value factors, and cost targets; there is no quantitative relationship between performance requirements and the worth of the functions identified.

To illustrate the problem, review the functional analysis of the mechanical pencil. The basic function of the mechanical pencil was identified as "make marks", and its worth was developed through evaluation by comparison with a common lead pencil. However, does the lead pencil represent good value when a value scale is imposed—when we ask, how many marks will $5.00 buy (250 lead pencils) when compared with the $5.00 mechanical pencil?

The point to he made here is: that in order to choose the best value alternative, it is necessary to consider all costs, analyze them, and then develop correlations of cost and performance parameters. The development of these correlations, or so-called value standards can be very useful in a given busines or product line where functions recur frequently.

4-4.2.2.5.8 Worth: Determine It; Log It

No matter what techniques, or combination of techniques, you employ to put a dollar sign on

estimates of *worth,* log those dollar values for each of the functions of assemblies and components, in the "W" column of Work Sheet No. **2** (Fig.4-4).

Be sure to record these *worth* estimates as you go—as you arrive at the first estimates. **As** you develop your functional analysis, these values for worth are, of course, subject to change and revision—and this is as it should be; *you are thinking!* The application of one technique for determining worth may develop a particular dollar value. Then, the analysis by another technique may produce a lower figure for worth—or a higher one, for that matter—all of which is going to call for judgment on the part of the Study Team. One value of worth must be selected as the *value standard.* That is why it is so important to log the various appraisals of worth as you go. It is even more important to note, on Work Sheet No. **3,** the development of the thinking of the study team in zeroing in on what is believed to be the most acceptable value for worth. Remember: your value standard (worth) **is** likely to be challenged, and at a much later date. When you are called upon to review your reasoning, you won't have to rely on your memory. Remember: you may not be able to remember. So don't try. Log it!

If you will practice this kind of self-discipline as to note keeping, you will have solved one of the biggest problems of the part-time technical communicator: too little information, too late. There is probably no area that so separates the part-time writer from the professional as this—the ability to keep notes. The "pro" wouldn't think of not notating his thinking as his mind goes into gear on a communications project. Why should you?

4-4.2.2.6 Know Your Costs

Thus far in the functional analysis phase, we have answered the basic (and critical question) *"What does it do?"* by identifying functions for each of our components. These functions described through the verb-noun technique, were then entered on Work Sheet No. **2.** Having identified function, then we answered the question, *"What is that (function) worth?"* by the use of various techniques for estimated worth, and logged these dollar values (for **"W")** on Work Sheet No. **2.**

Now we come to the third and last question of the functional analysis phase, *"What does that* cost?". It is a loaded question! Here's why: In most organizations, cost accounting procedures are used to collect and record "actual" cost data on a given design of product. But in VE we are not tied to a given design; our basic concern is with the value of the *function* that must be performed by the product. Therefore we are forced to come up with an *estimate* of worth to establish a *value standard,* because the "standard costs" of normal cost accounting are *hardware* oriented, not *function* oriented.

It should not be inferred, however, that cost data, as yielded by conventional cost accounting procedures, are not extremely important to the value engineer. These data are absolutely essential to a successful VE study because:

1. Analyses of cost data serve as a stimulant for ideas that produce savings.

2. Without cost data, we would have no basis for comparison of our value standard (worth) and would, therefore, be unable to compute our VIP.

3. Lacking meaningful and reliable cost data, we would be unable to establish the economic feasibility of the alternatives generated in the "Speculation Phase", and as appraised in the "Evaluation Phase".

4. If there is no careful analysis of cost data, the whole VE study would he extremely vulnerable to challenge, and there would be no way to authenticate savings or leave an "audit trail" for verification of those savings.

With this much emphasis on cost data and their analysis, it could be assumed that the value engineer—along with all the other "hats" he may he called upon to wear—is expected to be a cost accountant, as well. This, of course, would be desirable but usually impractical; this is why: it is extremely important to obtain information and assistance from the best possible sources in the finance or accounting activities of the organization. Better still, personnel from these activities should be represented on the VE study team, where they will be able to supply immediate guidance in cost data areas. However, all members of the study team, particularly the leader, should have a good overall grasp of the general philosophy of cost accounting procedures being used in the organization; understand how to prepare a basic cost breakdown for a component, consisting of

(Typical)

VE Study No. _____

FUNCTIONAL ANALYSIS

- List the assembly, followed by its components.
- List the verb-noun description of function for each assembly and component.
- Indicate the number of the note to be referred to on Work Sheet No. **3.**
- Determine what each function is worth (W).
- List actual cost (C) of the present manufacturing method.
- Calculate the Value Improvement Potential (VIP = **C** − W)

Figure 4-4. Work Sheet No. 2

Assembly Subass'y. (Components)	Function: Basic (verb) (noun)	Function: Secondary (verb) (noun)	None	Worth: votes, Nork Sheet No.3 (W)	Cost (C)	VIP

(Typical)

VE Study No. _____

DETERMINATION OF WORTH

Note No.	HOW **DETERMINED**

Report Notes: _____

Figure 4-5. Work Sheet No. **3**

material, labor, and overhead costs; and, in order to analyze costs, know how indirect and nonrecurring costs are allocated to the product.

In order to be able to enter the costs (C) on Work Sheet No. 2, it will be necessary to prepare a cost breakdown. An accounting sheet, such as Hammermill Ledger 18-416, provides a convenient form for this purpose. Use the "item" columns for listing the drawing numbers and €or identification of the major assemblies and subassemblies (or components), operations, or tasks being analyzed. Use the working columns to enter the costs of such elements as materials, fabrication, assembling, processing, finishing, inspection, test, overhead, etc. Reserve the last column to the right for totals. In each "element" column, enter the quantity, as well as the dollar cost for each of the elements, e.g., the weight of materials or the hours involved for a labor element.

The preparation of the cost breakdown (or rather the attempt to prepare it) may have some far reaching results and repercussions. The mere allocation of costs down to the level of subassemblies may pose a problem. The attempt to allocate costs to function is bound to be difficult; cost accounting systems are not set up to assign costs in this manner. Therefore, the study team is usually faced with the problem of making a conversion from the "hardware" allocation of costs (as compiled on the cost breakdown), to the functional allocation of costs (C) as entered on the "Functional Analysis" Work Sheet, No. 2. If the cost breakdown includes sufficient detail, it will be possible to allocate costs to the group or groups of parts that perform a function, and thus it will be possible to cost (C) the function. It should be noted that these groupings of parts to perform a function are not necessarily grouped in order of assembly hierarchy, but are grouped in a subordinate manner in accordance with the role they play in performing basic and secondary functions.

After having made such groupings on Work Sheet No. 2, it is then possible to add all the costs for basic and secondary functions and determine what the cost of these functions is. Then, it is possible to calculate the VIP by the

$$VIP = C - W$$

If this simple algebraic subtraction indicates a plus (+) value or variance for VIP, this variance shows that the function is costing more than the estimated value standard established for worth (W). Therefore, the function is costing more than it is worth, and we have a function showing potential for value improvement. These functions, therefore, become priority candidates for study in the Speculative Phase when searching for altemate ways to perform the function.

To tell the value engineer, and the Study Team in general, to "Know Your Costs" is an easy admonishment to make; to comply with the admonishment can get very involved, and is likely to challenge the ingenuity of the entire Study Team in making the conversion from "actual" costs to "functional" costs. But as techniques peculiarly adapted to the product and organization are developed, experience will indicate how to arrive at meaningful functional costs. Without the development of this skill, the remainder of the study on a particular project may be misleading and result in a waste of valuable value resources.

44.2.3 Speculation Phase

"There's a *way to do it* better .,. *find it".* On the way to that "better way" in our VE study, where do we stand? Through the Information Phase and the Functional Analysis Phase, we have determined what our project or item is, what it does functionally, what that function costs, and what it is estimated to be worth. Then from the data on Work Sheet No. 2 we were able to determine the most promising candidates of function (those with the best VIP). Further, we recorded our reasoning for determination of worth for each function on Work Sheet No. 3.

Now we are ready to list these promising candidates of functions, along with the VIP for each and speculate. In doing so, we are out to answer the key question of the Speculation Phase: "What else will do the job?"—what are "alternative ways for accomplishing the function?" But how do we "find" that "better", alternative "way"? We do it through creative thinking — a mental facility of which all of us are potentially capable, although we may not know it, or believe it.

4-4.2.3.1 Creative Thinking: Trick or Technique?

Ask most business managers about creativity, and they are likely to associate it, in a narrow

sense, with "brainstorming" and other over-publicized approaches to creativity. This fan-fare on the topic, along with unrealistic claims for its application, have detracted from management acceptance of creative thinking as a practical technique. This lack of acceptance is unfortunate; where incentive and stimulation for creative thinking have been implemented, progressive organizations have achieved many concrete benefits, These benefits are evident not only in the more effective utilization of the inherent creative abilities of its members, but in better communications, human relations, and employee morale, as well.

Creative thinking is one of the basic ingredients of a successful VE program. Therefore, to attain the great return that VE is capable of generating, the VE program can only flourish in a permissive atmosphere in which fresh ideas are consciously encouraged and permitted to flow freely up to decision-making levels. The conventional management environment that places strong emphasis on the ability to judge quickly and evaluate, must be de-emphasized, if not, the tendency to pre-judge ideas without exploring the potential of those ideas in depth, inhibits the generation of new ideas and stifles creativity. Creativity is a technique and can be put to work; in VE, it must be.

Creative thinking has been defined in one way as: "The process through which the mind produces new and useful ideas". It should be noted, however, that this mental process is not construed to be a replacement for conventional problem solving through the use of logic and analysis.

Jules Veme once remarked, "Whatever one man is capable of conceiving, other men will be able to achieve." In the Speculation Phase of VE we are doing just that, "achieving" an alternate, and possibly better way, to perform a function "conceived" by someone else. Through the creative process, the achievement becomes a reality.

There are a lot of populer misconceptions about creativity—that it is a gift possessed by a favored few and, therefore, it cannot be developed; and even attempts to develop it have no real practical application. All are "old maid's'' tales, and evidence is mounting fast to dispute such misconceptions. Although the precept is disputed by many, and still more people refuse to believe it, the Creator bas endowed all of us with creative abilities. If this were not true, it would not be possible to develop creativity in individuals — possibility that is being demonstrated daily, throughout the arts, sciences, and now technology. But this demonstration of inherent creative ability is slow of development because the every-day experiences and environment of most of us mitigates against creativity. All through our schooling, stress is usually placed on finding the one right answer to a problem, without sufficient consideration of the many answers that may be available—any one of which may offer certain advantages to the solution of the problem.

By the time the student is ready to enter the business world, he is so afraid of the word ***failure,*** that he is reluctant to pursue any path that may even be headed in the direction of possible failure. Mr. Kettering, the great engineering research genius, upon receiving an award for his work, is reported to have stated: "I'm not sure . . . whether this award was given for accomplishment or whether it was given for not taking my college education too seriously."

4-4.2.3.2 Developing Indivdual Creative Ability

If we were to tum the VE technique on ourselves in developing creative abilities and ask ourselves, "What is the one basic personal quality or function, we must strive for to he more creative?", we can supply the answer to the question in the VE verb-noun form: ***get guts!*** Once you set your sights on being more creative, you are going to need lots of the well known ***intestinal fortitude.*** Why? Because in attempting to be imaginative and creative, there will be lots of roadblocks thrown in your path and at your ideas; people resist new ideas because these ideas represent change. And, unfortunately, they also resent new ideas because inwardly they are kicking themselves for not coming up with the ideas themselves.

For example, generate a new idea and ask a group of friends or acquaintances to tell you what they ***like*** about the idea. Silence will usually prevail; you won't get many comments. Now reverse the procedure. Ask them what they ***don't like*** about the idea—and stand back! You will be proffered a long list of reasons why the idea won't work. Negative attitudes are inherent

in most people. To he creative, we must first overcome the negative trend in our own thinking, and be ready and willing to cope with the negative attitudes of others. We must accentuate the positive! Mental roadblocks (negations) within our thinking take many forms. To be introspectively alert to them is to develop the mental methods for coping with them.

Habit is a great stifler; we try to solve new problems by applying old (habitual) methods. Watch your habit patterns and be sure you are not trying to do something in the "old" way simply because the old is the way you have always done it.

Conformity too often forces us to follow the accepted route. We want the approval of others; to present new ideas may expose us to suspicion and appear to be a possible threat to the status **quo** *of* things. If we would be creative, we must risk being labeled a nonconformist.

Stress sort of sums up what we are liable to experience when we are determined to induce more creative ability into our thinking—it is mostly emotional stress, involving fear, desire, distrust, etc. We fear that if we are creative and make a mistake, we may appear foolish and will be the subject of ridicule. This, in tum contends with one of our strongest motivating forces—the desire for security. Our sense of security, is, in turn, often tied up with our associates and subordinates: we work to *impress* the boss first, and express creativity second; we often distrust associates and question their motives; we placate subordinates to avoid stress and "making trouble".

When it is all added up, we do make trouble for ourselves in attempting to be creative. It takes guts. But there are self-discipline techniques, when practiced, that will help to negate the negations and create a better mental environment for the new ideas of creativity. The mental back-drop €or the self discipline that leads to creativity is to always be aware that we are potentially creative, and that the more creative thinking we do, and the more ideas we generate, the more competent we become, Creativity is a regenerative process, and for this reason, discipline brings freedom.

The art of creative thinking actually has an element of sheer routine about it. Here are some suggestions for developing the routine:

1. Seek solitude—take some time to be by yourself, away from distracting influences, where you can get a chain of thought going and keep *it* going.

2. Know your mind—when it works best, when you are most likely to do your most effective cogitating. Every individual has patterns of times when his mind is likely to go into high gear—first thing in the morning . . . just before going to bed . . . in the bathroom . . . during a walk . . . while performing manual tasks. Know your patterns and nurture those periods; they are precious.

3. Keep *a* "paper memory"—catch those ideas that are generated during your best periods of "ideation". Always have some means handy for jotting down reminder notes—any phrase or group of words that will key your memory to recall the idea at some future time. Be alert. You are likely to say to yourself, "I'll remember that." But most of the time you won't, so don't try. Jot it down. Practicing this technique brings a two-fold result: not only are you likely to capture the idea, but recording all your thoughts will provide a visual reference that is very likely to serve as a catalyst for other ideas. Remember, creativity is a regenerative process.

4. *Foil* frustration—when and if you reach this mental state—by not worrying about it. If the ideas won't come or cease to flow, get away from it all for a while. Give your mind a rest, or turn it into other channels. Do some work with your hands or tum to your favorite sport or hobby. Relax! But after you do, keep the "paper memory" handy; you may he surprised how quickly your mind will jump back into high gear after these recuperative periods.

5. Set quotas for your creative effortsso many new ideas or approaches per day—and tell yourself you're going to reach them. This kind of self discipline seems to he at variance with the technique for foiling frustration; it is. There is a narrow line to tread. But through this kind of introspection, you will learn more about you than you've ever known before, and you will comprehend when to keep on pushing and when to ease off—on yourself. Remember, discipline brings freedom.

4-4.2.3.3 Stimulating Team Creative Thinking To Develop "Alternate Ways"

There is nothing so essential to group creativity as a free-wheeling environment. It is

up to the Leader of the VE Study Team to assure that such an atmosphere prevails, and as the chairman of the group, he will have to pre-empt the floor to guarantee that:

1. Judgment, criticism, and evaluation are eliminated from the idea-producing stage when the team is ready to speculate on "alternate ways" of accomplishing the function (Work Sheet No. 4).

2. All ideas, even those that seem impractical, are considered.

These rules encourage the development of a maximum number of ideas and prevent the premature death of potentially good ideas. If these rules are not enforced, there will be a constant shift from creative thinking to evaluation, instead of keeping the thought stream in channels for the exploration of new areas. This kind of group discipline forces the development of daringly creative approaches, often into areas of seeming impractibility.

The Leader also should remember that in many instances he may have some nontechnical people on the Study Team. If so, put them at ease. Encourage them to contribute ideas; it will pay to do so. Often, the nontechnical person is potentially the greatest innovator in technical areas. His viewpoint is freely objective; he doesn't know, technically, that certain things are "impossible". Often, the only way to discover the limits of the possible is to venture into the impossible. But the nontechnical person, surrounded by technical people, will never become an innovator unless he is encouraged and is given an opportunity to express his thoughts without the risk of ridicule.

The Leader, in setting up for the brain-storming Speculation Phase, should make sure that every member of the team has filled out a copy of Work Sheet No. 4, with at least the functions typed in the "Function" column. Sharing copies, or looking over someone's shoulder to get information is not conducive to creative thinking. In fact, at this stage in the study, every team member should have a data package on all the information that has been generated thus far in the study. In spite of the fact that this is a team, brain-storming effort, creativity is still a very personal experience. You will get more ideas if every member can do his own referencing to documentation on the study.

There are many techniques for inducing creativity, both in the individual and in groups, and many good hooks have been published on the subject. At least the team Leader would do well to he up on some of these techniques by study of these books. In arriving at "alternate ways of accomplishing the function", here are some general guides for keeping the group on the creative track:

1. *Go for quantity of ideas.* Not all ideas will, of course, he acceptable or practical. But quantity results in a synergistic effect, whereby one idea when combined with another idea — or induced by another idea — results in an increased overall effect. Therefore, when ideas are flowing freely from the team members, the Leader should not permit anything to interrupt this flow. Keep it going. The Leader (chairman) will soon learn those psychological tricks that will knock down the roadblocks of criticism, and the tendency to stop and evaluate an idea.

2. *Don't let any of the ideas get away.* Record them. When the team gets warmed up and enthusiasm is running high, taking notes on the ideas presented can be quite a chore and, therefore, it may he well to have a stenographer assigned to the task. But brief her. Have her watch the Leader for the cue on the important points to record. In such a free-wheeling discussion, verbatim transcriptions are out; they include too much "water" that must he filtered out to get at the real meaning. In all of this, the Leader has his work cut out for him; he will have to be a firm chairman—hut not too firm; he will have to govern the discussion with some adherence to *Robert's Rules,* but not to the degree that formality may inhibit creative participation.

In the Speculation Phase, it is very difficult to eliminate *functional fixation* from the minds of the team. We human beings find it almost impossible to visualize an object performing some new function other than the one with which we are familiar. The concept that must he encouraged is *adaption.* Thomas Edison once said, "Make it a habit to keep on the lookout for novel and interesting ideas that others have used successfully. Your idea needs to he original only *in its adaption* to the problem you are working on". Many successful VE projects have grown out of the adaption technique—taking an object that already exists and, by slight and economical modification, get the object to perform a new

(Typical)

VE Study No. . ———

SPECULATION PHASE

What Else Will Do The Job?

'UNCTION	VIP	ALTERNATE WAYS OF ACCOMPLISHING THE FUNCTION	
		No.	Description

Report Notes: _____

_____

_____

Figure 4-6. Work Sheet No. 4

function. Probably there really is "nothing new under the sun". The trick is to find what we need and make it work to fulfill our need.

The Leader also must watch for opportunities to subdivide a problem. A problem that has many possible facets can be a bit overwhelming for the team members. Therefore, break the problem down into smaller segments and consider each segment as an individual problem.

If at any time the flow of ideas from the team bogs down, they may need a change; to continually study a problem from a flat, two-dimensional print can be stifling. If possible, go to the shop or the assembly line, so that team members can actually see the object or part, or operation under study. "Live", three dimensional contact often serves as a stimulus to new ideas. It should be remembered that this live observation is particularly helpful to nontechnical people—who can be some of the best innovators on the team.

Team members should bring to the Speculation Phase a diversity of knowledge—and should make every effort to keep on diversifying their knowledge. Diversity engenders not only new ideas as such, hut it also provides a base for inspired innovation.

When searching for a "better way", it is imperative that the searchers be aware of trends. This calls for a hard look into the past as well as the future. Many costly trends have been perpetuated in products simply because no one stopped to ask "why?". Many products have fallen by the marketing roadside because no one was observing the trends that were blocking off entry to the market place. No one in the company, particularly in technological areas, should be any better informed on trends than the value engineer. Knowledge in this one area has assured the success of many VE programs.

A value engineer (an effective one, that is) is not afraid *to* ask questions. To him, asking for help or ideas is not a sign of weakness. Indeed, he is very much aware of the fact that his very VE life blood may depend not only on asking questions, but *how* he asks them. In most instances, he is dependent upon others for the information he needs. Therefore, the value engineer is a diplomat because he. knows he must keep his channels of information open. When he asks questions, he must be sure they are intelligent questions—ones that he could not answer for himself by a little pre-digging. Never does he sit down at a specialist's desk and expect to be given a quick course in electronic design, in hydraulics, in materials, in methods, or in any subject. He will have briefed himself first by a little boning on the subject and will, ever so deftly, let the person being interrogated know, that he (the value engineer) has ***some*** knowledge of the subject. Then, the person supplying the information will realize (with relief) that he is not being asked to go clear down *to* basic fundamentalsand will talk, and gladly. By this simple technique of question-asking, many "alternate ways" of accomplishing the function have been uncovered by the diplomatic value engineer.

In summing up on the ways to develop "alternate ways" through team effort, one word expresses it—planning. The value engineer, particularly the Study Team Leader, has a most demanding task to perform. He must guide, and keep the team on track. He must be a spark plug ready to re-vitalize the study effort whenever that effort seems to lag. He must be a good "chairman of the board'' ready to generate policy but willing *to* delegate authority for implementing the policy. He knows how to motivate to ideation, hut he also knows when to stop "inventing" and produce.

4-4.2.4 Evaluation Phase

In preparing for the Evaluation Phase, it may be well to review where we stand in the Value Engineering Methodology. In the Functional Analysis Phase we answered the questions: *"What* does it *do?"*, ***"What*** does that cost?", and *"What* is *it worth?"*. Then, through a rough analysis of costs, and through techniques for the determination of worth, we were able to calculate the VIP for each of the verb-noun, descriptions of function. As these data were developed, they were entered on Work Sheet No. 2.

What was the meaning of these data, and how would they become useful? At the end of the Functional **Analysis** Phase, we had, in effect, established a VIP priority of the various functions identified in this phase. By doing so, we were really establishing a means to conserve our VE resources. At the start of the Speculation Phase, our creative effort would

thus first he applied to those functions offering the best VIP. These VIP's were then listed on Work Sheet No. 4 in descending order of plus value, and we were ready to apply creative effort in arriving at "value alternatives". Those alternatives that survived the preliminary development, comparison, and combinations of the creative mill, are now listed by reference number on Work Sheet No. 5, and we are ready to start the Evaluation Phase of the VE methodology.

In this phase, we are going to develop choices between the various alternatives. In VE, these choices become functional-economic trade-offs. To arrive at the decisions necessary to make the trade-offs, we should observe that just as functional analysis was the principal tool for developing alternatives, economic analysis is the basic tool for comparing and evaluating these alternatives. However, before making the economic analysis we are going to further refine our list of value alternatives (Work Sheet No. 5) by a rigorous comparison of the technical advantages and disadvantages of these alternatives. Therefore, the Evaluation Phase includes two analytical. steps: a feasibility analysis and a resource analysis.

4-4.2.4.1 Feasibility Analysis

In comparing the advantages and disadvantages of a basic or secondary function remember: there are many more factors to be considered than merely making comparisons on the basis of what the product does; careful thought must also be applied to accuracy, reliability, environmental conditions, maintainability, safety, etc. As a guide, a thorough study should he made of:

1. Capabilities of research and development, design, manufacture, and service
2. Tolerances and limitations
3. Standards
4. Specifications and contractual requirements
5. Specialty products, processes, and suppliers

In performing the feasibility analysis, the VE Study Team can find itself in a real research project to truly and confidently assess the advantages and disadvantages of the value alternative. The assessment may be easy or difficult, and it is here that the real mettle of the Study Team will he established; it is here that keen judgment should he born relative to whether or not an altemative should be discarded or pursued; and it is here, therefore, that value engineering resources (yours!) will be carefully husbanded, or possibly wasted.

To attain the necessary level of judgment, literature search may be necessary, computer operations may be involved, and pilot tests may be required. Get information from the best possible sources, inside and outside your company. In effect, the study team would do well to pass the word, "Vendors Welcome Here". They can be a storehouse of clues for "better ways" of doing things. Get them in on your problem early. They are usually proud to share their knowledge—and be creative. They may present the very idea that will not only have a lot of advantages, but may also eliminate many of the disadvantages.

As the advantages and disadvantages are compared, kneaded, worked, and reworked—record them as you go on Work Sheet No. 5. Don't let any of this thinking process escape. Notice that you are still being creative (or you should he!), and that new ideas for value altematives will keep popping up. Record them too, and notate them in such a manner that you will subsequently know that these ideas were developed in the Feasibility Analysis stage. Keeping a running record of the development of the thinking has at Ieast two advantages: (1) you will have all the data you need to prepare a report and proposal on the study project; and, (2) a visual review of the record serves to stimulate new ideas.

As the list on Work Sheet No. 5 develops, the team will begin to find itself at the sifting, sorting, and selecting stage. Re-examine the disadvantages: are they inherent; can they minimize; do other ideas contain the same disadvantages? Do not discard an idea until the disadvantages appear to he serious and cannot be overcome. There should come a point when a diminishing return on effort is evident. The final output at this point should be several value alternatives that have stood the test and appear to be entirely technically feasible—from every standpoint. It is then time to "quit inventing" and put these alternative ideas under the scrutiny of economic analysis.

(Typical)

VE STUDY NO. _____

EVALUATION PHASE

Feasibility Analysis

VALUE ALTERNATIVE		BASIC ADVANTAGES	DISADVANTAGES
No.	Description		

Report Notes: _____

Figure 4-7. Work Sheet No. 5

4-4.2.4.2 Resource Analysis

The popular connotation on resource is with natural resources—our trees, water, soil, wild life, etc.—and it is in this vein that we are also likely to think of *conservation.* But the same concepts are applicable to industry. The resources of industry, like our natural resources, are not unlimited; they too must be managed to maximize their use and minimize their loss. Successful business is, therefore, a process of resource conservation involving a continuous regenerative cycle of converting money into products and services, and then back into money. Business management, therefore, is responsible for the function of keeping the cycle going by the selective allocation of resources. In this sense, then, VE becomes a management tool for creating savings and, therefore, a greater conservation of resources.

4-4.2.4.2.1 Ground Rules for Comparison of Costs

The VE methodology, based on identification and costing of function to create savings, is seldom compatible with the usual cost-accounting philosophies and procedures. Therefore, if the value engineer is to be in a position to present convincing economic arguments for his proposals, the value engineer and the management of his company, must work out a set of ground rules for cost comparison. Financial management must assure, and be assured, that all cost comparisons are made from the company's point of view. Therefore, the ground rules should establish guidelines for all cost comparison decisions concerning:

1. Labor rates
2. Treatment of overhead and burden
3. Source and basis of material costing
4. Make or buy policies
5. Use of learning curves
6. Use of contingencies
7. Allowable "broad-brush" techniques.

The ground rules should also establish what techniques are permissible and recommended for estimating costs in cases where cost data developed from historical information are not available or are not applicable to the VE approach.

The time factor in the cost picture must also be given consideration. Cost is usually treated as a fixed quantity, but it seldom remains fixed. The cost of a product will vary with the quantity produced, and with the period of time during which it is produced. Cost is also influenced by the pressure of demand on the product or service, and by the way company resources are allocated to meet the changing demand.

The value engineer must therefore be aware of and understand, in costing his value alternatives, the far-reaching economic impact of his proposals and be prepared to defend them in all areas of impact.

4-4.2.4.2.2 Economic Analysis

With ground rules for comparisons established, the VE Study Team is now ready to collect and document cost data. These data make it possible to economically evaluate the various value alternatives that have been established through the Feasibility Analysis (Work Sheet No. 5). A guide to the various elements of cost and the best sources for cost information are listed in Tables 4-1 and 4-2.

It is suggested that detailed cost estimates he developed on standard accounting work sheets. Then, the summary of the various elements of cost for each value alternative can be transferred to Work Sheet No. 6. Therefore, by this method of cost documentation, the total labor cost, total material cost, and total nonrecurring cost per unit, will have been segregated for each of the value alternatives. Then having made these segregations, Work Sheet No. 7 provides a convenient form to accomplish two things in the evaluation: (1) a comparison of the costs of the value alternatives with each other, and with the cost of accomplishing the function by the present method; and (2) computation of projected savings that can accrue when the proposed value alternatives are implemented. With these data documented, it will be possible for the study team to complete the Economic Analysis of the various value altematives and select those that are to be candidates for presentation as Value Engineering Change Proposals (VECP).

4-4.2.5 Presentation and Program Planning Phase

Up to this point in the VE Methodology, the Study Team has functioned principally as an

(Typical)

VE Study No. _____

EVALUATION PHASE

Economic Analysis

Description of Value Alternative, No. _____ Quantity _____

COST ESTIMATES

RECURRING COSTS

SHOP OR OPERATION	MANHOURS	RATE	COST

1. TOTAL LABOR COST

MATERIAL AND PURCHASED ITEMS	QUANTITY	PRICE	COST

2. TOTAL MATERIAL COST

NONRECURRING COST

TYPE	MANHOURS	RATE	COST

3. TOTAL NONRECURRING COST
4. UNIT NONRECURRING COST

Report Notes: _____

Figure 4-8. Work Sheet No. 6

(Typical)

VE Study No. _____

EVALUATION PHASE

Economic Analysis

COMPARISON OF VALUE ALTERNATIVE UNIT COSTS

Item Of Cost		Cost By Present Method	Value Alternatives (VA) 1.	2.	3.	4.
1.	Labor Cost Per Unit					
2.	Mat'l Cost Per Unit					
3.	Scrap, Rework, Contingency					
4.	Subtotal—Unit Mfg cost					
5.	Unit Nonrecurring Cost (From Sheet No. 6)					
6.	Total Unit Cost (4 + 5)					

COMPUTATION OF PROJECTED SAVINGS

7.	Subtotal Unit Cost (From line 4)					
8.	Quantity					
9.	Total Mfg. Cost (7x8)					
10.	Total Nonrecurring (From Sheet No. 5)					
11.	Total Cost (9 + 10)					
12.	VA Savings (Present Method vs. VA's 1, 2, 3, and 4)					
13.	Follow On Savings					

Figure 4-9. Work Sheet No. 7

TABLE 4-1 GUIDE TO ELEMENTS OF COST

Nonrecurring Costs:

- Purchased Engineering
- In-house Design
- Lofting and Drafting
- Tooling — Design
  - Manufacture
  - Proving
  - Material
  - Equipment
  - Inspection
  - Purchased Tooling
- Technical Publications
- Research Test and Development
- Subcontract Termination Costs
- Obsolescence of Inventory
  - Scrap
  - Rework
  - Replacement
- Qualification Costs

Variable Production Cost Per Unit:

- Engineering — sustaining
- Tooling — sustaining
- Raw Material and Hardware
- Subcontracted Parts
- Purchased Components
- Direct Labor
- Inspection
- Packaging
- Field Service, Maintenance, and Guarantee

The best sources for this information are:

1. Accounting
2. Industrial Engineering
3. Engineering Administration
4. Manufacturing Engineering
5. Production or Shop

For Competitive Pricing Situations:

- Make or Buy Policies
- General and Administrative Overhead
- Recommended Profit
- Fixed Overhead
- Variable Portion of Overhead

Other Factors:

- Shop Efficiency and Performance
- Spares Factor (for less than lot sized runs)
- Scrap, Replacement, and Rework
- Contingency for Incomplete Engineering
- Contingency for Incomplete Manufacturing Plan
- Labor Cost Increase Factor
- Economic Lot Sizes
- Special Handling
- Paper Work

TABLE 4-2 SOURCES OF COST INFORMATION

MATERIALS

Material costs cover the areas of:

1. Raw material
2. Purchased material (castings, forgings, circuit cards, etc.)
3. Hardware
4. Purchased components and assemblies
5. Subcontracted parts, assemblies, or services

The best sources for material costs are:

1. Paid invoices
2. Purchase orders
3. Material requisition
4. Supplier quotations
5. Supplier price lists and informal (telephone) quotations

PRODUCTION QUANTITY

The best sources for production quantity are:

1. Current contract schedule
2. Sales forecast
3. Past sales records

analytical group. But to perform as effective analysts, they have had to play many roles—acquire the necessary information, they have had to be diplomats adept in handling people and overcoming roadblocks; to come up with "better ways", they have had to be creative; to evaluate the "better ways", they have had to be technologists and cost accountants. Now, the value engineer will be called upon to play the most important role of all—the role that will make him or break him ... the role that will either augment or defeat all of his efforts to this stage in the methodology. Welcome to the role of salesman, Mr. Value Engineer! And, **Mr.** Value Engineer, the smartest move you can make is to look on this role as opportunity. Why? Because so few technologists and scientists have developed their abilities in this area.

Of all the wails emanating from the profit-seeking offices of corporate management, this one is heard the most—and voiced most frequently by executives responsible for the marketing of technological products and services: "Give me technologists who know how to fulfill their all important roles in the marketing function." However, any executive knows that such dual purpose engineers and technicians seldom exist. They don't come that way; the schools don't turn them out wearing those two hats. So, engineers have to be educated, technicians have to be told, and scientists have to be sold. They've got to he disengaged from the erroneous belief that "salesman" is a dirty word!

So, Mr. Value Engineer, if "salesman" is to you a dirty word, get rid of the thought—et rid of it, that is, if you want to grasp the dual opportunity that VE is presenting to you: not only do you have the chance to sell your VECP, but you have the even more important opportunity to sell yourself to management. Here is your chance *to* show management that here is a man who grasps and skillfully executes the technically-based sales function. But for the value engineer to develop this skill is going to require a lot of careful planning and practice. A meticulously organized plan for presenting the VECP will have be to created. Once created, the actual presentation to management must be practiced—and rehearsed. The word rehearsed is not chosen carelessly; in one respect you are going to put on a show, and engrossing showmanship is part of salesmanship, and good salesmanship **is** the result of effective communication. For these reasons, an entire chapter of this hook (Chapter 5) is devoted to the subject of communications, both written and oral, and how to use these disciplines effectively in selling your VECP's. Therefore, the points listed under pars. 4-4.2.5.1 and 4-4.2.5.2 will serve as a check list of the things you must do when getting ready to sell your VECP's.

44.2.5.1 Planning *Your* Program

Do not attempt to execute this part of the VE methodology until you have studied thoroughly the principles covered in Chapter 5. Note that to communicate (or sell) effectively, a great deal of thought must be given to two basic considerations, objective and audience. These points, therefore, are the first two of the Planning Check list:

1. Objective: Don't he content with a mental perusal of your objective in planning to sell your VECP. Write it down, and in doing so, be as succinct as possible. Remember, you may still face some selling of the basic philosophy of VE. Be prepared to defend why VE works, then prove *it* with your proposal.

2. Audience: Know to whom you must sell—who is responsible for approving your VECP for implementation. Know all about him; know what he knows—and, what he doesn't know. Again, write down the points that best specify your audience. You will not be able to do an effective job of selling unless you know your prospect. Ask any successful salesman!

3. Organize: Work, knead, mold, and reshape the organization of your plan of presentation. Time spent here will make your on-your-feet presentation much easier. Your plan must he logical and reasonably developed from beginning to end. Outline your plan and be absolutely certain that the thinking is unmistakably clear—*to* you. If it is not clear to you, how can it be clear to the audience?

The planning phase involves the development of a program for the implementation of the best VECP's. Such a program calls for the scheduling and interlocking of many events. Work Sheet

No. 8 can be used as a check list guide in developing the "milestones" and the order of their occurrence in planning a VECP for' implementation. Once this schedule for a program of implementation has been summarized, then, a plan for presentation of the program to management must be carefully worked out. The most effective way to clarify the presentation in your own mind is to write it out. When you do, keep in mind these four points of effective expository writing:

1. Break the audience preoccupation barrier. To do this, open with some dramatic or attention-arresting statement, but be careful of' waving the dollar sign **too** fervently.! Unfortunately, a great many value programs, have suffered demise at an early age because the promised dollar savings didn't materialize **as** planned. Don't forget that in many value programs the side benefits and carry-over to other product areas are often more importatnt than the instant benefits from the immediate program.

2. Involve the audience in the plan. Don't be naive! It is human nature for the boss, manager, or any member of your "prospect" audience to be asking—even though inaudibly—"What's in it for me?". This reaction is particularly likely to occur where change is involved. In any way you can, convince the members of your audience that they can benefit by adoption of your VECP.

3. Establish your case by a clear, step-by-step review of the VECP and the way it was developed. Know what you are talking about and have all the facts in your mind ready for instant recall. You must be thorough. Invariably, there will be some members of your audience with a "show me" attitude, just waiting to uncover some error or fallacy in the development of your program. Such a slip could kill your proposal. And if they can't uncover an error, they will attempt to throw "roadblock" questions or statements at you. Anticipate the roadblocks; be prepared for attack from any angle. **If** the VECP does contain certain disadvantages, cover these in your presentation; candidness in this direction could be an *advantage* to you; it could stifle some roadblocks before they are voiced, and thus prevent a snow-balling negative attitude about your VECP.

4. Make recommendations that lead to the inescapable conclusion that **your** VECP, if approved, is bound to fulfill the claims made for it in the attention arresting opening of your presentation.

4-4.2.5.2 Presenting Your Program

Before making your "live" presentation to your prospect audience, rehearse it with the members of the Study Team. Choose the best personality from the team for making the on-the-feet presentation. Then, have the "speaker" run through the presentation. **As** he does, time the length of the program. You will be in a much better position to get the acceptance of management if you can tell them how much time they will have to schedule for the presentation and because of this, you will look "organized".

Make certain there are no places where the presentation drags or where the reasoning appears to be faulty. Help the speaker with his delivery and encourage him to free-up and smile. Wherever possible, work graphics, demonstrations, or models into the program of presentation. To do so, produces several benefits: graphics provide a change of pace for the audience and give the speaker a chance to move about and not be riveted in one spot—like holding on desperately to a lectern! The use of flip charts is extremely effective, particularly where the audience is small enough for the graphics on the chart to be clearly legible. And the most dramatic way to use a flip chart is for the speaker to develop the material as he goes. This doesn't mean he has to carry the development in his head; a step-by-step outline, sheet-by-sheet, can be lightly penciled at the top of each sheet—visible to the speaker but illegible to the audience. But the speaker must always remember to never divide the attention of the audience between that which is oral and that which is visual. Whenever the content of the delivery shifts to a topic not illustrated on the flip chart, tum to a blank sheet, or at least to a sheet containing the information under discussion.

After the rehearsals of the presentation to the Study Team and the development of a smooth, convincing delivery, find out how convincing it is! Now use the heckler approach. The members

of the VE study team should try to imitate the anticipated reactions of the members of the audience expected to attend the presentation. Try *to* throw the speaker off balance—interrupt him.

Be sure the speaker requests that questions be held until the end of the presentation when there will be a question-and-answer period. Then rehearse this question and answer period. Anticipate all the questions that may be asked—particularly the most searching and personal ones. Be ready to handle the roadblocks!

It is important for the audience *to* understand that the VECP is the result of a team effort. Therefore, it may be advisable to portion out parts of the presentation to members of the team in areas where the abilities of the member are known and respected. For example, the technical aspects of the VECP could he presented by an engineer on the team; costs by a team member from cost accounting or finance; and, in the case of purchased parts, by a member from the purchasing department. No matter who makes the presentation, always bear in mind: your prime objective is to communicate—to convey information. If this objective is attained, the selling function will usually be automatic.

In preparing for the live presentation, be sure to review the techniques of oral communication as outlined in Chapter 5. Here are some points that will help to keep the speaker on the track:

1. Use your personality *to* sell your plan. Remember, this one personality is yours and yours alone. Study your good points and develop them. Also, try to be objective about your weak points and work to rise above them. This is an opportunity to improve you and your professional recognition. Use it!

2. Always be aware that everyone has an ego and that everyone is inclined to protect that sense of ego and individuality—at all costs. Constant awareness of the "other guy" and his feelings is, in one sense, being mercenary; this awareness, and a display of it, **will** help you get what you want.

3. Learn, remember, and use the name of the person being addressed. This is flattering-and he will always remember you.

4. Be a good listener—a courteous, sympathetic, and cheerful one. **As** you practice this kind of patience, don't worry about time; many sales have been made without the salesman opening his mouth.

5. When the time is right (a sense of timing that can be developed) **ask** *for* the *order*—ask for approval of your VECP. Many surveys on salesmanship indicate that this is the area where salesmen are most vulnerable; they are afraid to ask for the order. You must know that your VECP is a good one and you must reflect this conviction. Communicate as well **as** reflect that conviction—then respectfully request approval.

4-4.2.6 Implementation Phase

Before the VECP is implemented, the value engineer must insist on written approval. Such approval should be expressed in the company's **VE** statement of policy. However, in most instances, the effects and changes involved in a VECP will be sufficiently far-reaching, that everyone concerned will not comply with the VECP unless it does have management approval in writing. Once approval is obtained—move! Until the program is implemented, there are no savings, and no increase in value.

Work Sheets No. 8 and No. 9 can he used as guides in logging the progress in implementing the VECP. Follow-up on implementation progress is a must. It should never be assumed by the value engineer or his company that value engineering effort is complete with the approval of the VECP. It has only begun! In spite of approval, the VECP is still likely to encounter roadblocks at any point in the implementation. Therefore, the company applying the VE methodology must realize that, if the methodology is *to* he truly effective, value engineering effort is a full-time, organized, continuous responsibility. The company that approaches VE with this philosophy, and backs up the philosophy with written policy, is truly in a position to benefit from the high savings-to-cost ratio that VE is capable of generating—10:1, or more.

(Typical)

VE Study No. _____

PROGRAM PLANNING PHASE

Schedule Data Sheet

Value Change Proposal No. Title

Drawing No. Developed By Date

Milestones		COMMITMENT Best	Probable	Worst	Approval and Date
1.	Value Chance Proposal Submittal				
2.	VECP Approval and Go Ahead				
3.	Prototype Model Complete				
4.	Lab Test Complete				
5.	Field Test Complete				
6.	Specifications Complete				
7.	Design and Value Review				
8.	Product Engineering Go Ahead				
9.	Engineering Release				
	a. Long Lead Items				
	b. All Dwg. Complete				
10.	Process and Mfg. Engineering				
	a. Tool Design Complete				
	b. Tools Complete				
	c. Process Sheet Complete				
11.	Quality Control				
12.	Purchasing				
	a. Long Lead Items				
	b. All Parts				
13.	Value Review				
14.	Work Authorization				
15.	1st Lot Available to Subassy.				
16.	1st Lot Available to Final Assy.				
17.	1st Lot Completion				
18.	1st Lot Released to Market				

Figure 4-10. Work Sheet No. 8

(Typical)

VE Study No. _____

IMPLEMENTATION PHASE

Value Change Proposal No.	Title	
Drawing No.	Developed By	Date

	Present	Proposed	
1. COST ANALYSIS UNITS			
a. Material Cost	$	$	
b. Parts Labor			
c. Assembly Labor			
d. Scrap, Rework			
e. Purchased Components			
Total Cost	$	$	
Total Proposed Savings			$
2. IMPLEMENTATION COSTS			
a. Product Engineering			$
b. Tool Design			
c. Tool Manufacture			
d. Special Tools/Machinery			
e. Other Nonrecurring Costs			
Total Implementation			$
Breakeven = Total Implementation / Proposed Savings/Unit			$

ACTION REQUIRED	BY	DATE	COMMENTS
MARKETING			
PROD. ENG.			
PRODUCTION			
PROCESS ENG.			
PURCHASING			
SERVICE			
Q.C.			

Figure 4-11. Work Sheet No. 9

Figure 5-1. Effeteor Effective?

CHAPTER 5 COMMUNICATIONS IN VALUE ENGINEERING

5-1 IMPLICATIONS IN GENERAL

5-1.1 EFFETE OR EFFECTIVE?

Both management and VE personnel have inescapable responsibilities in the area of communications. When the word communications is used, the intended reference is not merely to the act—the mechanics, of writing or speaking. Daily, millions of words are put on paper, and millions more leave the lips—and most of us know by our daily experience, how very few of these words perform their true function, i.e., convey information.

In VE, communication must be effective. Effete verbiage in any branch of technology retards the conveying of ideas; but in VE, reports and presentations that lack vigor will lead to only one result—a dead methodology! Heed these words of warning:

1. "If the report does not communicate effectively, the whole (VE) study is in jeopardy." (Value Engineering, Handbook H-111, Department of Defense.)

2. "The worth of a VE program will be directly related to the ability of the value engineer to communicate." (Stanley C. Drozdal, Value Engineering Consultant, Albany, New York.)

3. "...swift and efficient communications are essential to value achievement." (Frederick S. Sherwin, Director, Value Engineering Service, Raytheon Company).

But why is so much importance placed on communications in VE? Astute management already knows that communication is one of management's most plaguing problems. Is the application of VE going to accentuate that problem? It is! But in the very act of doing so, VE could bring to management, relief in *two* problem areas—costs and communications. VE engenders change and it is this basic characteristic that forces the VE practitioner to face a dual problem in communications; not only must he convey information, but he must, as well, ouercome one of the strongest human traits—the resistance to change.

For these reasons, an observation (one that is certainly not original), is in order: contemporary technology is being forced to give more and more consideration to the humanities; VE does. It does, that is, where VE is being successfully applied. This methodology requires the development of the creative skills that will produce the new ideas that lie inherently dormant in most of us. In presenting his ideas, the VE practitioner is forced to become adept in handling the human relations problems that are the outcome of anything new. Through creativity, as applied to the development of convincing and effective communications, the value engmeer must "sell" his ideas to those who must implement his ideas.

Therefore, VE, in spite of the many demands this methodology makes—or perhaps because of these demands—presents to the individual and management alike, unparalleled opportunities far growth. In fact, it is not unreasonable to state that value engineering represents one of technology's most important contributions to the economics of business and industry. But, as has already been stated, the key to these contributions can very well lie in technical communications. If they are effete—forget it. But if communications are truly effective, everyone benefits, However, in too many instances technical communications are effete rather than effective, because there is such a limited understanding of what technical communication really is and what the discipline involves. Is it art or science? Is it akin to "literature" (in the classic sense)? Is it necessarily "proper" English? How good a vehicle is our language for conveying technical information? The questions are basic. If we would communicate effectively we must know these answersand more,

5-1.2 ART OR SCIENCE?

There is too often a tendency for the mind trained in the sciences and technology to view expository writing with a pragmatic attitude. These part-time writers look for a "go", "no-go" formula that will always assure the proper

approach to any problem in communication. But as any professional writer knows, no such formulas exist. There are too many variables. Audience, objective, syntax, rhetoric, length and type of coverage—all, and more, must be given careful consideration if the communication, written or oral, is to he effective. Communication is an art, not a science. However, any scientist or engineer, who will approach his communications chores with the same thoroughness and self discipline he has been trained to apply in his basic profession, will communicate more effectively. What design engineer would attempt to design a device without a set of specifications for that device? What scientist would embark upon an investigation without having established an objective for himself? But ask the same engineer or scientist to prepare a report or a paper, and usually he fails to discipline himself in the same way he did when performing the very work he is writing about!

Writing is an art, hut the production of effective copy is susceptible to the thoroughness of the scientific approach.

5-1.3 COMMUNICATION: SOLVE IT OR. SLOUGH IT?

The effectiveness of the communications produced in any organization is a direct reflection of management's attitude about communications. In too many instances, it is hoped that the problem—particularly technical communication problems—will just go away and get lost. Unfortunately, the attitude seems to prevail that there isn't much that can be done about the problem anyway: Whenever the scientific or technical writer is charged with producing copy that is unclear, he immediately surrounds himself with the cloak of erudition; his readers don't understand him because they are not in his discipline! But time and time again, surveys of the readership for scientific and technical literature indicate that neither do members *of* the same discipline understand the author!

It is true—much technical and scientific writing is of necessity involved and complex, and ,employs a language (jargon) understandable only by those in the know. But must the whole piece of writing be directed at those in the know? Couldn't an introductory portion of the copy be addressed to the less informed audience—at the audience who approves expenditures? The technologist who is wise enough to take such an approach to his communication chores, who is adept at actually *conveying* the necessary information to management, is the technologist who will get professional recognition—and funding! But to attain this state of idea-and-information conveyance, implicates both management and personnel in the communication process. If VE is to he successful, the implications for both are inescapable. Both must work at solving the problem, not sloughing it.

5-2 THE IMPLICATIONS FOR MANAGEMENT

5-2.1 VALUE

Management ***wants*** value in communication,, but is usually not willing to pay what effective communication is believed to cost. This belief veils many fallacies. Prevalent among these false beliefs is the assumption that because a man has a college degree, he should be able to write. The inept, on-the-job communication performance of many persons with degrees should have obliterated this assumption a long time ago. College-trained persons are not entirely to blame; very few of them get training in the basic techniques of writing, let alone the subtleties of communication. Research into this deficiency bears out the point. A recent survey of over 100 major industries indicates that many otherwise competent young men are being denied promotion because of failures in the use of English grammar. So, the moral seems to be: "Give our engineers some brush-up on their grammar. Bring in an English professor for a few hours of lecturing, and we should get better reports." Better, yes, but still not good enough.

Over 25 years of experience in working with engineers and technical writers shows conclusively that much more than a mastery of grammar is required to produce technical copy that truly conveys information. In fact, the most glaring weaknesses in reports and papers produced by engineers and scientists are not principally in the areas of grammar and syntax; ineffectiveness is usually the result of the inability (or lack of mature diligence) to organize and plan meticulously. The art of

technical communication requires a mature mind. Therefore, progressive educators, who are at long last beginning to study the problem, admit that: if the syllabus for a course in technical communications were properly designed and vigorously taught, it would very likely exceed the intellectual capacities of the undergraduate student; the precepts of such a course would he most efficiently learned and practiced at the advanced-degree, or on-the-job, level.

In view of the many false assumptions about the abilities (or inabilities) of individuals to communicate effectively, the implementation of a VE program can result in benefits to both the company and its personnel. However, these benefits will accrue only if the VE program is comprehensive—including training in technical communications.

Everyone *talks* about the vital role of communications in VE, and how the success of the entire VE program depends upon "effective", "efficient", and "fast" communication. Then practically none of the existing VE training programs or seminars offer any instruction in even the fundamentals of communication. If these training sessions were to include technical communication instruction, the companies who participate could expect their personnel to come away with immediately-applicable procedures that would help to cope with two of the most pressing problems facing business and industry: costs and communications. With practical guidance in those two problem areas, the price of admission could he a bargain—whether or not formal VE programs were subsequently implemented!

If' management truly decides to improve the communications produced by its personnel, management has certain responsibilities. These responsibilities must he assumed by management whether or not its personnel has had specialized training in communications. In general, there is not a sufficient appreciation for the profoundness of the technical expositor's task. He, the part-time writer, is forced to work in an environment intolerable to the professional writer. The engineer usually is required to submit to inept editorial criticism without any clear-cut establishment of editorial standards as ground rules. His reports are something that is expected, without any advance planning or conference, to just happen at the end of a project. If management were to occasionally stop and take stock of its technical documentation per page costs, possibly more effort would be applied to the *management* of technical communications. Attention even to some of the fundamentals could greatly reduce the costs and improve the value of technical communications.

5-2.2 ENVIRONMENT

Writing, if well done, is a creative process, demanding uninterrupted concentration. Yet, most engineers and scientists are expected to write effective reports at an open desk, in a big office, with phones ringing and in a general atmosphere of commotion. Management would do well to provide a "writing room" or some facility where it is possible to develop and maintain a chain of thought, without breaks to answer the phone or questions. When management truly grasps the profoundness of the technical expositor's task, it will he just as acceptable for the secretary to say "He's writing", as it is for her to now say, "He's in conference." With privacy for the part-time technical writer, an understanding of his problems, and a sympathetic respect for the demands on him, management would likely increase the productivity of copy, reduce its costs, and improve its quality.

5-2.3 TRAINING

Leading management consultants estimate that as high as 50% of the operating costs for business and industry go into communication efforts of some kind. "Writing", of one form or another, must make up a large portion of those costs. Yet, how little attention is given to the improvement of "value" in this problem area, even in general communications, let alone in the much more profound discipline of technical communications. Specialized training in this type of communications will help. But the training must he administered with the full understanding that what are usually considered to he writing problems, are usually not writing problems at all; they are psychological problems, It takes more than instruction in grammar and syntax to produce technical copy that conveys; proper English does not necessarily make for effective communication. The training must

motivate to write well, and must embrace an understanding of the technical message to be conveyed—and demonstrate the techniques for the effective conveyance of that message.

5-2.4 EDITORIAL STANDARDS

In this area, management must do more than establish ground rules for the proper use of the language, format specification, and the mechanics of the written word. These are essential, but not enough. Editorial standards should also imply a "standard" of conduct, editor-to-writer, and vice versa. Over and over again, experience has shown that the spirit of potentially effective part-time writers, has been killed by the boss (editor) who says of a piece of copy, "I don't like it"—then fails (or is unable) to offer the constructive criticism that would explain. *why* he doesn't like it. It is almost a universal and unanimous plea of engineer-scientist writers receiving training in the techniques of technical communications "I wish the boss would take the course". And he should!

Management will never attain ***value*** in technical communications until editor and writer alike are working to the same set of ground rules. The desired function for communications, to convey information, will never be reached until "editors" realize what a delicate problem in human relations is entrusted to them when passing judgment on the words that someone has taken the trouble and energy to put on paper. Inept criticism and inconsiderate comment will drive the writer to "impress" the boss, rather than "express" ideas. The situation is analogous to the choice of a tolerance by a designer simply because, on a particular part, that tolerance has been used for years without ever asking "why"—the "value" question that could lead to greatly improved value potential.

The writer who is forced to impress rather than express, gets smart and follows a similar procedure: he goes to the file and gets a model of copy that will guide him to impress. Until this human relations problem is corrected, true value in communications is impossible.

5-2.5 PLANNING

Management must inculcate in the engineer the responsibility to fulfill a two-fold mission: to not only *do* the *work,* but also to ***report*** the work. Because of the many bogies he faces—lack of confidence in his abilities as a writer, lack of training, inept editing, and because good writing is hard work—the engineer would much rather be doing the work than reporting it. Much of this ill feeling toward writing builds up because of lack of planning for the writing project. A conference to specify the objective and readership for the report should take place between the boss (editor) and the engineer before the work is started. When agreed upon, these data should be recorded, then reviewed periodically throughout the progress of the work.

5-3 THE IMPLICATIONS FOR PERSONNEL

5-3.1 IT IS NOT ALL YOUR FAULT

Don't feel too badly if it appears that a very important, part of your education (training in writing) has been slighted; you have plenty of company. It is very possible that even though you had been instructed in the art, not enough of it would have rubbed off on you, or stuck with you, to provide you with an effective tool to be used at this stage in your careers. Why? Because the art of effective exposition requires a mature mind—a status not usually achieved at the undergraduate level.

You students of mature minds must attain the objective of technical communication—to convey new information. Think about this statement for a while—"to convey new information". Now if this **is** our basic objective, how do we attain it? We convey, or communicate, new information by thinking, not by writing. Or stated another way, by thinking first and writing second. Therefore, you must learn to think more clearly—on paper.

We bear on every hand that technical communications must be precise, clear, comprehensive, etc. True! But effective technical communication involves much more; to convey new information effectively and efficiently, also involves logic, psychology—and even philosphy. We begin, now, to see that we are reaching out much beyond the parameters of ordinary grammar, syntax, and rhetoric. It has taken us a long time to learn, and an even longer time for educators to admit, that proper English does not necessarily make for effective

communication. A great deal more is involved. So, involve yourself. Determine to be a more effective communicator. If you are not, you can improve your skills in this all-important area. Use that mature mind of yours to practice—the only way proficiency is developed in any art. There is no area where the engineer has a greater opportunity to get personal recognition. In spite of the mass of technical data and information being generated, the whole world of technology still cries for readable technical copy. VE does more than cry for such copy; its life depends on readable copy.

5-3.2 LINGUISTIC COMMON SENSE

If you were to stop and think about the problem of writing, you would begin to apply the same kind of common sense you use in your approaches to engineering, and the result would be more readable copy. Common sense and a hit of observation show us that we, in effect, use two kinds of English in our daily lives, Familiar English and Functional English. We use Familiar English in our contacts with our friends and family, and we use it reasonably well because we speak without timidity. But, what happens when we write? We don't use good Functional English—the kind that is readable and conveys information. We get all stuffy and pompous and feel we must put symbols on paper to impress and not express. Therefore, try drafting your next report as though you were telling your best friend just what you have been doing on your project. Just let the words come out in Familiar English. Then rewrite and polish to put the copy in goad Functional English. You will be surprised how well the technique works.

5-3.3 START EARLY

Before you can convey information effectively in either Familiar or Functional English, you have got to think about what you are going to write. Most part time writers don't start the process early enough. Procrastination is making your writing jobs a lot more difficult than they should be. No matter what that job is—everything from a prosaic paragraph to a recondite report—you will do it easier by starting earlier.

Whenever you have a writing job hanging over your head, at least start thinking about it. You don't have to be at your desk to do this. Learn to put your mind in gear on the project, no matter where you are—at any time when your mind doesn't have to be occupied with the immediate task at hand. If you will learn to practice this kind of cogitation about your writing tasks, you will soon find out how much smaller they get. I do mean cogitation—not just aimlessly thinking about the writing to be done. (Webster defines cogitation as: "to meditate upon; to reflect; to plan.") Thinking can be without plan; cogitation can't.

If your writing task is small, you may he able to get by without a written plan of some kind, but you are usually better off setting down some sort of specification for yourself—even for a letter. Yon have got to have a set of design parameters for your piece of writing. You must think through these limits even if you don't set them down. Without cogitating on these points you will fail to give your reader what he expects, and you won't know *what* you are going to say, or *how* you're going to say it.

Never—let me repeat it—never, start a piece of writing of any kind without setting down the answers to the following questions:

1. What is the information for?
2. For whom is it intended?

Keep distilling the answers to these questions until you can put your answer for each into a single sentence. If you hadn't already noticed, you've got yourself a challenging little writing project right there! But then, this sort of discipline and practice will make you a writer, and you'll he surprised how much easier you'll do it, each time you try it. Anybody can write a lot of words; it takes an effective communicator to cast his ideas in brief and concise copy. Don't you agree, this is not too much to ask of engineers—we who have been trained to be analytical, precise, and accurate?

There are other dividends to be collected for stating our objective and specifying our audience. When later you do your data compilation and outlining, you **will** know how to sift and sort every point in developing the kind of information that gets into the reader's mind and stays there. This kind of stick-in-the-mind of the reader information is the result of meticulous organization. Therefore,

organizing to write is the most important phase in the writing process. You can use your high school or college teacher's best English grammar; you can punctuate precisely according to the rules; you can construct smooth flowing sentences; but if you don't organize your writing logically and in a sequence that will lead your reader from one point to the next, you may as well not write at all. Before you can hope to write clearly, you must first think clearly. You must systematically think through what you are going to write before you put anything on paper. If you have the opportunity, discuss your thoughts with someone in order to fix your ideas in your own mind before you try to communicate them to others. How can *you* hope to communicate an idea clearly if it is not clear to *you* as the writer?

The best way to organize to write is to set up a mechanical step-by-step procedure which, if followed, will automatically and unconsciously lead you to the end product, a well-organized paper. Organizing to write encompasses more than just choosing a pattern or organization. There are certain preliminary steps which have to be followed before selecting a pattern. The directions and questions which follow are arranged in a logical sequence, to be used as a check list to guide you step by step through the development of your organization. If you will learn to follow these directions and always answer the questions, in writing, your copy should never again be criticized as "disorganized".

1. Determine Your Purpose:

   a. Why am I writing?
   b. Do I want to:
      (1) Inform
      (2) Influence
      (3) Instruct?
   c. What is the information for?
   d. What reaction do I want?

2. Analyze Your Reader:

   a. Who will read it?
   b. What is his scope of experience:
      (1) General background
      (2) Specialist
      (3) Layman?

3. Scale Your Subject:

   a. Will I need detailed support for my ideas?
   b. Will broad coverage do the job?
   c. About how many words?

4. *List* Specific Ideas.

   a. What are they?
   b. Can I judge, criticize, eliminate, or combine these ideas?
   c. Can I choose the important ones?

5. Group Like Ideas Under *Main* Headings:

   a. Can I group main ideas?
   b. Are they all main ideas?
   c. What are the subordinate ideas?
   d. Can I put ideas in order of importance, one, two, three . . . etc.?
   e. Is a pattern indicated?

5-3.4 KNOW YOURSELF

Those who have technical information to communicate cannot easily afford the time or labor that good writing entails. But, neither can they afford not to write. To most technical people, writing is an irksome task. This is so, in part, because in too many instances management does not yet grasp the profoundness of the effective technical expositor's task. Management wants effective technical communication, but, too often management is not willing to allow the writer sufficient time to produce effective technical communication. But this situation is changing. So don't despair—you technical people who must write. Just remember that, in spite of the many bogeys you face—lack of time, unsympathetic management, etc.—you are the ones who will benefit most by making every effort to get the most from your writing chores. Therefore, *know yourself*—and what you're after! At this stage, forget all about anyone else or what anyone else may think of what you have to say, or the way you're saying it. Put out of your mind grammatical limitation, style, or anything that may hamper you in accomplishing the task at hand—getting it down.

You will very likely discover, as even professional writers do, that the hardest job of all is getting started, that is, getting started at writing when it's time to write. Your outline is complete, you've given the subject a lot of good thought, the words should come out, hut they don't. At this stage you are likely to become aware of a multitude of insidious, silent, suggestions crossing your mind—all trying to tell you that you are not quite ready to write—your pencils need sharpening, you must call your wife, better prepare for that **PTA** meeting, the boss won't like it, I'm no writer, and so on, ad infinitum.

Stand up to these suggestions; meet them. Psychologists and professional writers don't seem to be able to explain exactly why these suggestions come, except for the apprehensions we entertain about performing an irksome task in an area where we feel unsure of ourselves. But come they do, and any professional writer will tell you that there is only one way to overcome these suggestionsstart writing! If you must, write your name over and over. (That is the remedy suggested by one well-known writer who makes his living at writing.) Just getting some words on paper seems to break the mental roadblock. So, if you experience this kind of obstruction when you are ready to write, don't he discouraged; you have lots of company. Keep in mind, every time you practice this kind of self control, there will he fewer roadblocks the next time; you will do it easier. Discipline brings freedom.

If you will work for this kind of discipline and this kind of freedom in your communication chores, your VE proposals are hound to stand a better chance of approval and implementation. Remember—the success of VE, and therefore your success and recognition as a skillful practitioner of the methodology, can depend on your ability to write readable, understandable copy. It is worth going for!

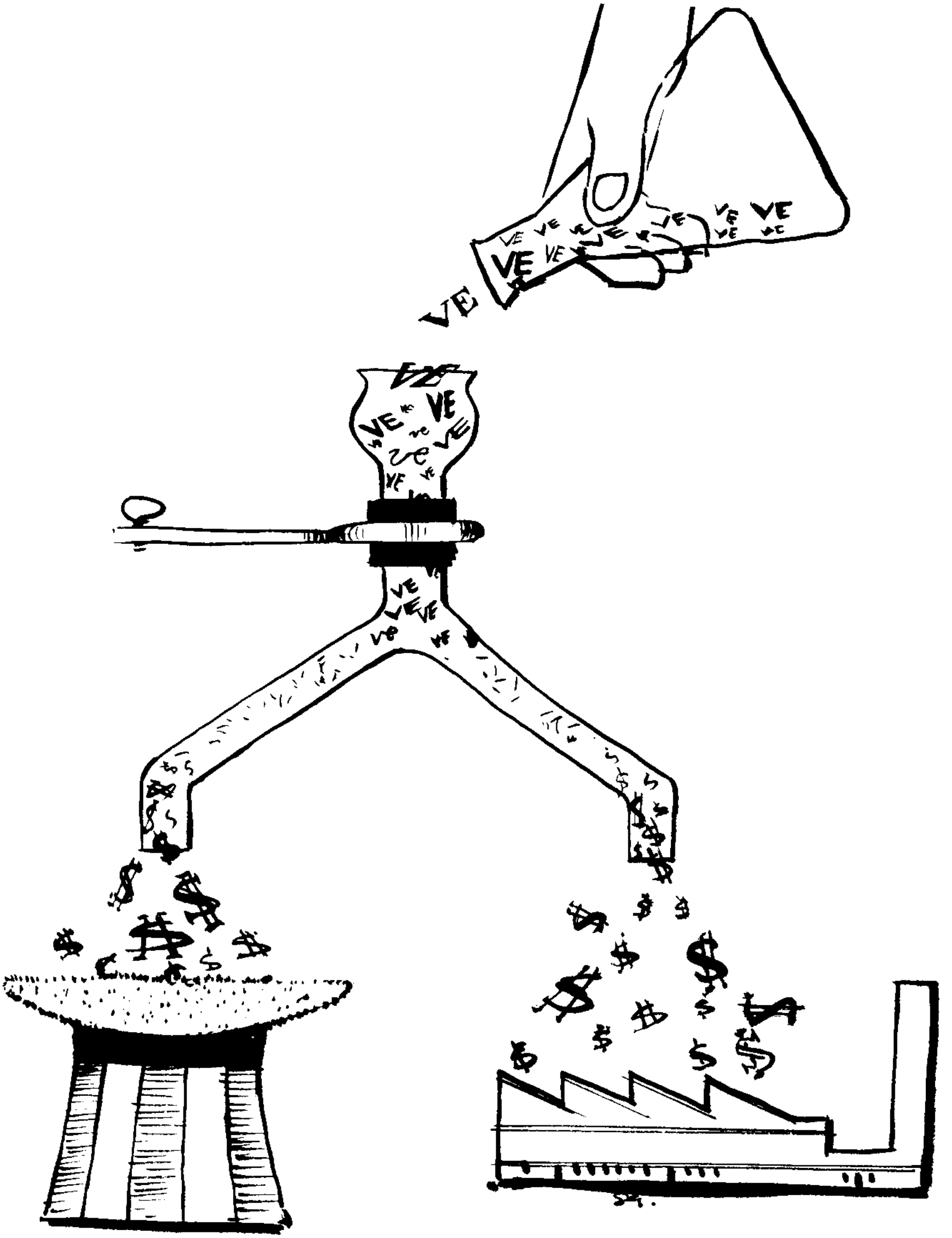

Figure 6-1. Catalyst for Change

CHAPTER 6 THE VE/DOD/INDUSTRY COMPLEX

6-1 DOD vs CONTRACTOR (OR VICE VERSA)

6-1.1 SKEPTICS: BOTH SIDES

The Department of Defense (DOD) is in business to buy the most defense for the tax dollar. Industry is in business to make money. To the uninitiated, the basis for a meeting of the minds seems obvious and clear-cut. But anyone who has ever been on either side of the fence knows that there are certain kinds of problems that have, for years, been plaguing the DOD/Industry relationship. Basic among these problems were DOD procurement policies that permitted no deviation from specifications or requirements—specifications that detailed down to the lowliest nut and bolt. It was difficult for a contractor to get a change approved even when the change could be validated as to lowering costs and improving performance.

But the revolution has started and it probably began several years ago, when gradually, specifications were first written to put emphasis on performance, letting the contractor use his judgment and expertise in the choice of materials and configurations that would result in the required performance.

Then, only a decade ago, VE began to appear on the DOD/Industry scene. VE brought with it the biggest revolution yet; contractors were not only encouraged to present changes for improvement in costs and performance, but were offered a share in the resultant savings. But in spite of the advertised mutual benefits on both sides of the DOD/Industry fence, there are still skeptics—hoth sides of the fence. And why not? **A** system that has been in operation so long, cannot be changed overnight. **Why** not? Because, we as human beings, for one thing, don't operate that way: we like the status quo and we resist that which may disturb the status quo.

But the skeptics, both sides of the fence might **as** well resign themselves to change. We live in a society of change and, in a way, the alterations in the manner of doing business between DOD and Industry, is only a reflection of that change. Change is here to stay. Therefore, the sooner we learn to live with it by contributing instead of resisting, the sooner the benefits will accrue—to both sides of the DOD/Industry fence.

6-1.2 CATALYST FOR CHANGE

VE is that catalyst. Why? Because the stakes are big. What other methodology has ever offered to share up to 30% of contractor-generated savings with the contractor? What other situation has ever started DOD on the road to shopping on the basis of quality, instead of the dollar sign? What other policy has ever stimulated DOD to develop a Contractor Evaluation Plan (CEP) that will get the contractor closer to the next award? What else has ever impelled DOD to offer Industry so much help in making ***more*** money, not less?

But, if VE is so great and has given birth to so much beneficial change, why hasn't it been more readily embraced and implemented? DOD wants more VECP's and certainly contractors want to make more money. Why is the meeting of the minds so difficult? VE is suffering from severe growing pains—so severe that had it not offered great potential for gain, it would have died (or been killed!) long ago.

Because of the tremendous potential in the savings offered by VE, DOD is making every effort to clean its own house to stimulate the submission of VECP's and speed up their processing, once they have been submitted. But why the emphasis on the contractor? Why doesn't DOD do more in-house VE? It is. But, for very practical reasons, the actual practice and application of VE must be the responsiblity of the contractor. The Defense Contract Administration Services are currently handling more than 300,000 contracts representing approximately 3,000,000 items. To develop only an in-house VE capability to cope with this kind of product volume is infeasible. Therefore, the required VE effort must become a part of the expertise DOD expects to buy in its procurement programs with industry.

DOD is well aware that it must prepare to encourage and assist the contractor in the practice of VE—and this tremendous administrative complex is doing just that. But a

lot of patience, consideration, and understanding will be required (on both sides of the fence) for DOD to get the VECP's it should get, and for contractors to get the increased financial rewards they should get. DOD must prepare to help, and Industry must be prepared to take advantage of that help.

6-1.3 PREPARE AND BE PREPARED

Top echelon managers in DOD are cognizant of the tasks they face in preparing to do a better VE educational and motivational job on Industry. They are beginning to demonstrate in-house revolutionary changes by:

1. Conditioning personnel for change itself
2. Developing a better exchange of information through readable, understandable, and swifter communications
3. Practicing what they preach about VE—by demonstration, if necessary
4. Training management not to judge "by the book" alone, but by judgment based more on reasonableness and fairness
5. Overhauling policies and procedures
6. Altering attitudes
7. Heeding complaints.

Industry would do well to do as well—for its own benefit. Industry might as well resign itself to the fact that VE is in the DOD complex to stay, and Industry should therefore prepare itself to take advantage of the help that DOD (the party of the first part) can and will give in saving money for the government, and in sharing those savings with Industry (the party of the second part).

6-2 THE PARTY OF THE FIRST PART

6-2.1 THE DOD CHALLENGE: PREPARE FOR REVOLUTION

It has been stated by top DOD personnel that VE must be woven into the fabric of DOD management. This sounds innocuous enough, but if the "weaving" operation is really implemented and aggressively pursued, DOD is preparing for a revolution creating that vigorous change of climate that will produce what DOD is determined to get—more VECP's—and get them from both in-house and contractor organizations. The "fabric of DOD management" is of necessity, broad, and therefore the "weaving" will be broad in scope, involving communications, personnel and training, procedures, attitudes, and procurement policies.

All of which may sound as though VE is just getting started in DOD. Not so. VE began to be a part of the DOD management fabric in 1959, after its effectiveness had been conclusively established by both the Navy and the Army. In the succeeding years, the revolution has been gaining impetus slowly, but the rate is increasing, in spite of the fact that the percent of contract awards saved annually thus far is less than 1%. This seemingly insignificant VECP performance, instead of killing the effort, has, because of the tremendous potential for gain, served to spur the effort. The objective is firm. DOD wants, and will get, the volume of VECP's necessary to greatly increase the savings—and is, along the road to those savings, taking a hard, cold look at its own house. Where flaws and weaknesses are uncovered in the "fabric", DOD is willing to admit their existence, and is making attempts to mend and reinforce them. That is revolution !

6-2.2 OVERHAUL THOSE COMMUNICATIONS

Today, on every hand, we hear talk about communications. Herein lies the difficulty; we *talk* about it, but we don't *do* much about it. The point was mentioned in Chapter 5, but it bears repeating here: Handbook H-111, ***Value Engineering,*** published by the Office of the Assistant Secretary of Defense (Installations and Logistics), states; "If the report does not communicate effectively, the whole (VE) study may be in jeopardy". And, with even stronger emphasis, this Handbook further states: "Design the report to secure approval; anticipate objections and provide the answers. Remember—if the reader has to stop to get more information, the report may be dead".

These are emphatic admonitions about the importance of effective reporting. But the admonitions need to be implemented with training, both in-house and in the industrial community. We continue to talk and complain, about even the run-of-the-mill, everyday brand of communication, but how much is being actually done to improve skills in the subtleties

of technical communications? Every VE seminar should include some training in technical communications—how to create the effective report, the techniques involved. We assume that everyone, particularly those with college degrees, should he able to write. But the product is not supporting the assumption.

At least, top DOD people are admitting that, if contractors are to he really encouraged to submit more VECP's, then, when these documents are submitted, they must he handled more expeditiously. Decisions must he made promptly, and those decisions must be clearly communicated to the contractor. If the decision is negative, he must he told why. If the decision has not been reached, the contractor must also he informed of such. The organizational mechanics of prompt handling are being developed. That is progress. The training for the improvement of ***quality*** in technical communications should he a natural follow-on.

But aside from speed or quality in communications, too often there is complete lack of the generation and exchange of information. Many VE benefits, projects, and savings go unobserved because they were not reported ***at all.*** The importance of reporting must be better understood and implemented, particularly at the buying office level.

6-2.3 SHOW AND TELL

In spreading "the word" on VE, we can well borrow a grade school educational technique. But it should perhaps he turned around: tell and show.

DOD personnel are admonished on every hand to he good public relations men for VE in all their contacts with contractors—to ***tell,*** the VE story; to persuade and encourage; to sell the effective application of VE. Persuasion and encouragement are fine, hut what happens if persuasion and encouragement don't bring about the desired result—greater contractor participation in the application of VE and the submission of more VECP's? There is only one thing left for the DOD proponent of VE to do: show the contractor! If VE has really become a way of life with the proponent, he will be able to demonstrate as well as expound; then he can go into the contractor's plant and actually show the contractor where the true function of his product is very likely not being fulfilled in the best or most economical manner.

This sounds like a big order, for it appears that we are actually requiring every DOD VE "rep" to he of consultant stature. We should! At least, those who go out to "sell" the contractor should he of this stature, and there should be at least one "rep" with this capability in every DOD agency. If not, it's like sending David out to encounter Goliath—hut in this case, it is David who is going to get himself killed! Put another way: DOD VE "reps" have got to be able to practice what they preach and also, they had better he hacked up with in-house, successful VE projects. This also gives them something to "show" the contractor rather than just "tell" him.

The word is "dedication". Dedication grows out of desire; desire is the result of motivation; and motivation is the product of effective training. If the training at present doesn't take the VE proponent through these experiences, then either the training is ineffective or the wrong person has been chosen to he a VE "rep",

The VE "show" instead of "tell" capability is not so difficult to inculcate in the true proponent of VE. Techniques are available for a "Quickie, One Hour" analysis of items to qualify items for a VE project study. But to develop the on-the-spot ability to apply the technique in the VE profession, as in any profession, requires ***practice.*** Any true practitioner of VE, does indeed make the VE philosophy a way of life. At the root of the skill lies the ability to practically instantly identify the true function of an item, a service, or a procedure. But this skill is only developed by practice and comes by observing the objects and actions with which we come in contact every day of our lives. The dedicated practitioner of VE is continually asking himself: "Now how would I identify the function of that object? If I were called upon to design and produce the object, would my verb-noun description ***of*** function give me room to develop alternatives, or would it he *so* broad as to not serve as a proper guide?" When we get VE "reps" who think this way, we have a "pro" who will he able to sell the VE methodology—by "show" as well as "tell"!

6-2.4 ALTER THOSE ATTITUDES

The DOD value engineer might be the greatest "show and tell" representative, but unless his attitude is right, his mastery of the techniques of the VE discipline won't help him much. All of which is a truism. But of all businesses, VE is particularly a people business. VE fosters change, which people resist, and therefore the VE representative must reflect an attitude of sincerity, understanding, and cooperation—hoth in-house and with the contractor—if people are to be won over to the cause of VE.

In working in-house, the proponent for VE is bound to encounter inter-discipline problems. Effective VE work necessarily intrudes upon the professionalism of others. There are times, therefore, when the VE representative will have to assume the role of the arbiter—will have to summon all the patience and diplomacy at his command. To keep the VE show on the road, play it real cool!

Now let's shift the scene. In-house VE has been on the road—and successfully. Now we face another human frailty: the competition for recognition. Strangely enough—or is it strange?—that those who resisted putting the VE show on the road in the first place, are now the first to step into the limelight to take the bows. In fact, these are the ones who will elbow, if only a hit, to get the spotlight. Spot them early. To be able to do *so* is also a skill, like the identifying of function, that comes with experience and practice. When you have leamed to spot these individuals early, you will be able to handle them earlierand easier. Assure them, early, that when VE work is really effectively executed, there is more than enough recognition to go around.

In your contractor contacts, you will also meet resistance, but of a different kind. Here you'll meet obstacles erected principally by the dollar sign. And this is understandable; always remember, the $ is the symbol of business. Prior to establishing the contact, at least for the first time, do what any good salesman does before he calls on a new prospect: find out all you can about the prospect. You will sell him easier if you understand his problems, what he is doing, and what he bas done in the past.

It has been said that most Govemment service people automatically assume that all contractors are rich—or will shortly attain that status through the current contract! This is an attitude that ***must*** be altered. If harbored, your. rapport with your client is attenuated right from the start. Even if this state of affluence is true (or about to be), you are there to show the contractor how to get even richer through VE. Don't worry, either DCAA or IRS will very likely get back a good piece of that affluence for your employer! But seriously, the implementation of VE as you know (or *must* know) can lead to big money, to high stakes. That dollar sign, with anything even approaching five figures behind it, puts a lot of people up tight; they begrudgingly approve anything in excess of their own annual income. If you begin to experience these feelings, step back, try to get the big picture.

Put yourself in the contractor's shoes. He too has problems. He, too, has bosses—often his stockholders. In most cases, he will get a nice fat share of savings, because, through his ingenuity, efficiency, and management he created those savings. Chances are, he would not have attempted to create them unless he had been assured of a fair climate to get his share. That was your job!

6-2.5 POLICE THOSE POLICIES

DOD management is well aware of the fact that to get more VECP's, it must go to the source of those proposals, the contractor. Policies must ever be improved to:

1. Sincerely invite VECP's
2. Assure a fair climate
3. Keep the contractor informed
4. Expedite decisions
5. Appreciate the contractor's problems.

However, DOD management is also aware that the volume (and quality) of VECP's can be no better than the contractual and procurement policies that generate (or suppress) the submission of VECP's. Therefore, policies have and are evolving that will permit a more realistic and effective placement of VE contractual clauses, and the administration of the results (and benefits) that should accrue. But, giving VE a better environment in which to operate, seems, in many instances, to run head-on into design freeze and configuration management policies. A lot of patience, judgment, and skill is going to be

required—and probably over the long pull—before compromises and balances are worked out. However, it will he done. The VE methodology, in combination with rapid technological advances, is revolutionizing procurement philosophies.

For example, the thought has been advanced that insistence on a design freeze would seem to indicate that the quantity of items to be purchased is of no concem. The rationale goes like this: the lifting of a design freeze-permitting VE to go into action—could generate a considerable saving, freeing a greater amount of dollars to buy more units and at a reduced per unit cost. Further, the feeling is developing that any situation which injects delay whether it be design freeze or hang-ups on decisions, brings that system or material rapidly closer to obsolescence.

Therefore, everybody is being forced to play the game by an ever-changing set of rules. For this very reason, everyone .concerned with administration, and management—whether it be in research and engineering, purchasing, procurement, production, test, etc—should understand what VE is, and what it can and cannot do. At present, the attitude is far too prevalent that VE is for engineers only—that it is some nebulous functionary "over there" somewhere that is reputed to cut costs, hut usually turns out to be just more paper work. The push for the inclusion of VE clauses in all contracts can do just that-create more paper work, without saving anything. In fact such poor judgment can actually he wasteful of resources. Good VE consultation must he available—and used, whenever the VE contract clause is considered for inclusion.

The push for a greater volume of VECP's without a skillful monitoring of the overall effect on the life cycle of the product or system, can also be disastrous. Of what avail is an approval of a VECP to save $1000 by a design change, if downstream, in testing and maintenance procedures, changes are estimated to cost $10,000?

Long term vision is required in this business of VE management. Experience is beginning to indicate that the earlier the introduction of VE into the life-cycle, the better. In the concept stages, better information is available, more alternatives for attainment of function are present, there is less resistance to change, and there is greater opportunity to "bird dog" potentially promissing VE areas. At the other end of the system or product life cycle there is the maintenance area—estimated to represent a $13 billion annual bill for DOD, and therefore a potentially fruitful area for VE.

All signs point to a policy of shop early and long for quality—through VE.

6-3 THE PARTY OF THE SECOND PART

6-3.1 MR. CONTRACTOR

Suppose that one day you receive a call from a DOD agency, asking you to come visit them; they have a very interesting contractual proposition they would like to discuss with you, after having evaluated all proposals for a new weapon system. A few days later you arrive for your appointment with the top-level men in that agency. The head man speaks:

"Bill" (that's you), "Your company has a very good reputation. In your particular specialty we know that you have the skills and experience to do the kind of job we need; we are in a position to make you a very interesting offer.

"Our estimate of costs on this project, take it well into the seven-figure class. Because of your reputation for running an efficient operation, we know that you could therefore make a reasonable profit out of good performance on this project. But there is more.

"In this project, we are particularly (we must be) interested in quality. In addition, we want to buy the creative abilities your staff has exhibited in the past. We want your Ideas—your proposals for change. We want to he absolutely certain that every black box in this system is doing the job it is supposed to do—is performing the function it was designed to perform, and doing it for the lowest possible cost without any risk of degradation of reliability or producibility.

"And Bill, from your standpointsince you are in business to make money—here is the most important aspect of this project: 30% of every dollar you save the Government with your generation of ideas and approved proposals for change on this contract, will he your share in those savings.

"Does that sound attractive to you, Bill?"

Of course, your first reaction is likely to be

reflected in your answer, "You're putting me on; what's the catch?"

The head man replies; "The catch is VE. If you will apply this proved methodology cn this project, we know you can realize a bigger percent profit than you've ever imagined was possible."

Mr. Contractor (the party of the second part) this could happen to you. VE, along with all the other revolutions that are occurring in DOD procurement policies, are making such offerings possible.

6-3.2 NO WHIM OF WASHINGTON

Make no mistake about it. DOD is convinced that VE will work and thereby create great savings for the Govemment and result in very attractive financial rewards for the contractor. Look at it this way: in fiscal year **1967,** the DOD awards to eight major contractors, totaled over **$3,393,000,000,** but not one of these contractors generated any savings to DOD (or augmented their own profits) through the submission of VECP's. That total award averages out to over **$424** million per contractor. The effective application of VE has repeatedly shown a return on investment of anywhere from 10:1 to 20:1. Mr. Contractor, wouldn't it be interesting to get the stockholder reaction to passing up this kind of return on investment — sound speculation that offers to increase profits hy over **$4** million?

6-3.3 KNOW THE GROUND RULES

The rules by which the VE game is essentially played, are spelled out in the Value Engineering Clauses of the Armed Services Procurement Regulations *(ASPR's).* It is true, the "spelling out" leaves room for interpretation — the kind of interpretation that can mean lots of money. Therefore, be prepared. The VE clauses are, like every other contractural clause, subject to negotiation. To bargain effectively, understand:

1. Value Engineering Change Proposals *(VECP's),* Class **I** and Class *II.* Know the difference and the relative merits of each. Your sharing in savings can hinge directly on the determination of whether a VECP is Class I or 11. If a change is ruled Class I, you must share savings with Govemment, but on Class II, you retain all savings.

2. VE Incentive Clauses and VE Program Requirement Clauses. Here the facts must be understood about direct and indirect costs, in relation to the type of contract. Understand ahead of time where you stand.

3. Identifying VE Effort. There must he methods for doing this, to the exclusion of similiar types of effort. It must be possible to associate this effort with a specific work objective.

4. VE Costs should be separately accumulated and identified–regardless of where they are finally charged.

5. Product improvement and VE effort must be distinguishable, one from the other. This is not easy to do, unless someone who understands VE methodology rides herd on the identity of the effort.

6. VE implementation costs must be deducted from the savings eligible for sharing. Therefore, these costs must be well documented —— d possibly for audit.

7. Change of base cost can he a big factor in the savings eligible for sharing. If your actual costs for a part exceed the contract, or negotiated, price, your share will he greatly reduced. On the other hand, your share—the reward for efficiency—will be greatly increased if you produce for less than the negotiated price.

In summary, your chances for better sharing and less audit frustrations will he greatly enhanced by always creating an "audit trail" in your VE work.

6-3.4 GET ON THE CONTRACTOR EVALUATION PLAN (CEP)

Want to get nearer that next award? The DOD is evolving a CEP and VE performance is becoming a part of that evaluation. So, even more than dollar incentive is being offered through VE. Can any contractor afford not to be interested?

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